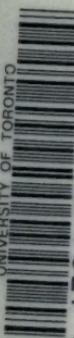


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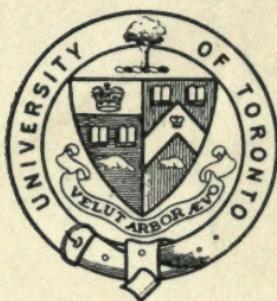


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GUIDE TO

# TECHNICAL WRITING

T. A. Rickard



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Graduate of the University of Toronto,  
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explorer, and scholar

J.B. Lyman







A GUIDE  
TO  
**TECHNICAL WRITING**

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—BY—  
**T. A. RICKARD**

Associate of the Royal School of Mines  
Formerly Editor of the Mining and Scientific Press  
Editor of The Mining Magazine



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**SECOND EDITION**  
(Second Printing)

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## **PREFACE TO THE FIRST EDITION**

This little book is intended to help those who wish to write clearly on technical subjects. My experience in professional writing is not long enough to have entailed loss of sympathy with beginners, yet it is sufficient to have taught me the value of a guide in these matters. Rules are useful, but the understanding of the reason on which a rule is based is better. No man can apply a rule intelligently until he understands when to disregard it. Such hints as I have put together are those suggested by daily practice as an editor; they claim no finality; all of them may not prove acceptable; but if they provoke greater attention to the fundamentals of good technical writing, this essay will have accomplished a useful purpose.

**T. A. RICKARD.**

San Francisco, May 1, 1908.

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## **PREFACE TO THE SECOND EDITION**

The exhaustion of the first edition of this little book and the kindly reception accorded to it, have prompted the publication of a second edition. In the appendix will be found some additional matter, namely, a paper read before the Institution of Mining and Metallurgy. This refers mainly to British usage and contains a few minor repetitions of remarks appearing in the earlier pages of the book. But repetition is not objectionable in an effort

to lay stress on errors of practice; therefore I have let it stand.

As might be expected, the advice that I have volunteered has laid me open to the charge of assuming a position of authority for which I have no official sanction. Most of my readers will waive an apology. Reformers do not wait until they receive official appointment. My purpose is evident. As an editor who was once a mining engineer I am in sympathy with the profession to which I formerly belonged and I am keenly aware of the necessity for care in technical writing, the importance of it, and the possibility of betterment. Fortunately, the cause does not fail with the fallibility of the advocate; in this little book, and in the sundry other books for which I am responsible, the observant critic will find many errors, such errors as hinder most of us when we try to write intelligently and intelligibly on technical subjects. But I have been learning and am learning still, by the application of the ideas and methods that I now offer to others equally willing to learn. The worst of all waste is the waste of experience. Such as I have, I give. I write as a scribe, without authority, except in so far as the members of my old profession will concede it to me from the nature of my present occupation; I speak as a student, not a master; as an amateur who has become a professional, but not a professor.

T. A. RICKARD.

London, August 1, 1910.

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## INTRODUCTORY

It has been said that in this age the man of science appears to be the only one who has anything to say, and he is the one that least knows how to say it. This applies with particular force to the technical expert, whose science is utilitarian and who, therefore, even more than the philosopher, is inclined to disregard the help of correct literary expression. In fact, the suggestion of attention to such minor matters is apt to be considered merely the irritating emphasis on a non-essential. The editor of a Denver mining paper felt assured of support when he expressed the opinion that attention to the niceties of literary form was a mere "frill"; all that was needed was "to get there," that is, to say what you mean in your own way. This view of the matter receives endorsement, in deed rather than in theory, from many writers on technical subjects. Moreover, the men of the mining and metallurgical professions are usually too busy to write leisurely, and in their hurry they are apt to be heedless of the qualities that enable language to fulfill its purpose.

Herein lies the root of the matter. Language is a vehicle of expression designed to convey ideas from one man to another. It was not intended for the soliloquy; civilized man does not live by himself, nor does he talk to himself. The spoken word is heard by those present; the written word reaches those at a distance; the printed word is intended to be read by thousands. Careful composition facilitates the conveyance of ideas, the primary purpose of writing being to transfer ideas from one man to

another in such a manner as to give the least trouble to the recipient. At best human speech is a clumsy vehicle of thought; much of the idea is lost in transit; too much energy is consumed in the effort to arrive at the mental destination. Obviously we should endeavor to make the transfer as complete and as direct as possible. Conscientious writers try to improve their mode of expression by precision of terms, by careful choice of words, and by the arrangement of them so that they become efficient carriers of thought from one mind to another. Careless scribblers do not trouble themselves either to be precise in their terms or nice in the selection of words; they deem themselves hindered in the freedom of their speech by the rules of grammar; they regard form as a fad. As the Denver critic said, they "want to get there." But that is exactly what they fail to do, for "getting there" means the successful conveyance of ideas from their minds to those of their readers, and this they are unable to do because their terms do not describe the things they refer to, their arrangement of words is turbid, their sentences are involved, in fine, their vehicle of thought does not perform its proper function. It is as if a man wanting to transport a load of potatoes from his farm to the nearest town, were to put them, not in sacks, but loosely, into a wagon that needs repair, and then took any road that offered, driving without regard to ruts or stones, but rapidly and carelessly—just to get there—without wasting thought as to the manner of the performance or attempting to put on any style—just get there—at any time, in any way—while the potatoes get shaken and bruised, some fall out of the wagon, and the few that survive are hardly worth cooking. Another farmer with

a little more sense, puts his potatoes in sacks; he lays the sacks so that they rest securely in his wagon, the wheels of which are well oiled and all the gear in excellent running order. He takes the most direct way, avoids obstacles, drives with a light but firm rein, keeping his eye on the road, and without loss of time delivers his potatoes in first-class condition to the nearest market. You can vary the parable and you can add to it many details illustrating different phases of this subject.

Among professional men the idea seems to prevail that a technical paper at its best is bound to be dry and that it is of no particular consequence how it is written as long as it is free from errors of fact and inference. To many of them the evidence of finish in the diction or of charm in the treatment savors of a sort of literary effeminacy, the introduction of an element foreign to the subject and calculated to weaken the force of a statement. Of course, it is possible to spend so much energy on the manner of writing as to dilute the matter almost to extinction, as a man can be so careful about the choice of his wagon and the selection of his road that he fails to reach the market with his load of potatoes until after dark. But technical writers rarely err in this way; on the one hand the subjects they choose do not lend themselves to rhapsodies, and, on the other, the careful use of the pen tends to crystallize thought, producing simplicity, so that the clearness of the writing is due not to the poverty in ideas but to the precipitation of them.

It being granted that writing is an instrument for transmitting ideas, we can appeal to the engineer on the score of efficiency—the fetish before which he bows continually. It might be expected that he would

try to make his writing as efficient as possible. All his training is toward precision, and in his daily work he recognizes the need of the right thing in the right place; nevertheless, in his writing he is prone to employ terms of precision with all the carelessness of a boy in the new possession of an air-gun. Although he writes continually, whether it be reports, specifications, or letters, he is apt to consider a precise mode of expression as too academic for practical purposes. One consequence of this indifference is that those who know him only by his written records are apt to undervalue his ability.

Science is organized common sense. Is it sensible to take great pains in developing ideas and then to be careless in the transfer of them? If not, then the scientific man is unscientific in his writing. Not that I would rate the manner above the matter; for we all know people with a fatal facility for expression; they have nothing in particular to say, so they write for the daily press. But in technical and scientific literature, whether of periodicals or of books, the complexity of the subject is permitted to kill the charm of the writing and it would seem as if the worth of the matter were considered so evident as to make the manner of presenting it a superfluity. This is done despite a general appreciation of the value of art in writing. Two examples may be quoted from among great writers. In Ruskin the wording is so exquisite that the science is secondary. Take the fourth volume of 'Modern Painters' and read his description of the mica schist on the top of the Matterhorn; it has the charm of poetry, and the cadence of music, even if it be not orthodox geology. Then turn to Huxley and read his essay

on a bit of coal; there the description is clear and the exposition luminous, science and art are wedded in an essay the form of which is as perfect as the work of an artist; the thought, as profound as the utterance of a sage. That is indeed scientific literature.

While engineers and geologists have had to burden their library shelves with a lot of half-baked material, and while they often suffer from mental dyspepsia by reason of the chunks of knowledge, without dressing or *garniture*, placed before them, they have reason also to be grateful for some dishes of technical information, well-cooked, served with *sauce piquante*, and adorned with the parsley of pleasant fancy. To Rossiter W. Raymond, Henry M. Howe, and Edward D. Peters, for example, we are indebted for luminous literature sufficient to demonstrate that technology is not necessarily a desert of dry things. In geology the scope is wide, for the fairy wand of the constructive imagination is waved over the musty page and awakens the imagery of art, irradiating the library of the scientific man like those parterres of brightly tinted flowers that spring into sudden life after the rain has fallen on the West Australian desert. Among the living authors on geology to whom we owe a memorable amount of delectable reading are John W. Judd and Archibald Geikie in England, while in America there are a number skilled in this regard, notably S. F. Emmons and F. L. Ransome. If the geologists are ahead of the mining engineers and metallurgists in felicity of expression, it is largely due to the fact that most of them have undergone an academic training before taking a special course in science; consequently, they have ac-

quired some feeling for the proper use of language and a command of words that practice has cultivated.

It is not for me to say much about style, for even the definition of this term involves elaborate analysis. The technical writer may well begin by trying to learn the use of "proper words in proper places," that is, effective expression obtained by precision, in order that the writer may economize the mental labor of the reader. After a while he may acquire such skill that his words convey more than their dictionary meaning and on rare occasions he may even weave a beautiful fabric illustrating the complete harmony of thought and expression. But the first principle of style is to say a thing so that it is understood. Then out of the several ways in which an idea can be stated, choose the particular way that will make it bite into the understanding of the reader for whom it is intended. If you describe a stamp-mill to an experienced mill-man, a mining student, or a bishop, you will vary the manner of telling. The most effective will be that which has a sympathetic appreciation of the other fellow's receptiveness. Do not plant carnations in a clay soil, or rice in a sand-heap. As a rule the process is simplified by the fact that technical writings are intended to be read by technical students, and, there being an accord between the writer and his readers, he can adopt a uniform manner, namely, that which is natural to the professional man when dealing with professional matters. Therefore the "great art" of Pater, the "inevitable phrase" of Raleigh, or the "personal style" of Symonds are alike in bad taste, because they are out of place. They are not fitting. On the contrary, the ideal is Spencer's "economy" of

time and words by saying what there is to say so that it cannot be misunderstood.

Technical writers should take two precepts as their guide: First the "proper words in proper places" of Swift; and then, "the style is the man" of Buffon; that is, precision and sincerity. Affectation is the worst of faults. It is a compliment to a writer to be told that he writes as he talks, always supposing that he does not talk wildly or carelessly. We like those who are natural and that is why the most effective writing is natural. There are those who, when they prepare matter that is to be printed, affect a vocabulary and an idiom foreign to them, just as some queer persons have society manners as distinguished from their behavior at home. There are public occasions, of course, when a certain dignity of bearing is befitting; for similar reasons it is proper that the irresponsibility and ease of ordinary talk should be modified when making statements for print. On the whole, if mining engineers, metallurgists, and geologists were to write their articles as letters to an honored professional friend, the result would be satisfactory.

Bad writing is due to two fundamental errors: on the one hand, entire disregard for the manner of expression, as though it were of no consequence; and on the other, subordination of the matter to the manner. The first was illustrated by the Denver editor\* already quoted; the second is typified by the stylists, who wrote with a skill far beyond anything worth the saying that they had to say.

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\*He has laid down the pen and is now less like a bull in a china-shop; whether he wields the sword or the hoe does not greatly matter.

Write simply and clearly, be accurate and careful; above all, put yourself in the other fellow's place. Remember the reader. Fluency of diction, largeness of vocabulary, ease of execution, and the distinction of a particular manner, if they come, will come with practice.

Young engineers—and even some of the older ones—have been known to express the desire to be able to write like Dr. Raymond, for example, evidently thinking that it is a sort of heaven-sent faculty or else something of a trick, the clue to which they might discover. I venture to say that in writing, as in many other things, it is practice that makes perfect. You will find that the men whom you regard as skillful with the pen are those who have written a great deal, even if they have not published all of it. Raymond writes with a pen or pencil, usually the former, because the rigidity of the pencil is more fatiguing to the hand than the elasticity of a pen. What he writes is subsequently typewritten, of course, but by writing himself in long hand he is able to look over the first draft as a whole, and make such corrections as will avoid the necessity for a second typewritten version. At the same time it must be added that he dictates business letters and he can dictate a long article or even legal testimony, punctuation included. Skill in any department of human activity is apt to be the result of taking pains, and writing is no exception.

Constant dependence upon a stenographer tends to repetition and lack of lucidity. It is no wonder that the technical men who are dependent upon a stenographer do not acquire a satisfactory manner of writing; for many of them only put their pen to paper in order to make a signature. When dictating, a man does not have

the opportunity to see what he has just said, to note how it hangs together, to cull and to correct as he proceeds until the entire statement expresses his exact meaning. It is certain that dictation makes for diffuseness and repetition. Herbert Spencer's experience was that after he employed an amanuensis his writing became prolix. In his later volumes he could cut out a quarter or more, whereas in the earlier books the texture was so close as to render condensation unnecessary. On the other hand, the use of a typewriting machine by an author is open to less objection and obviates some of the dangers of dictation, although it does not afford quite the same facility for correction as the pen or pencil. As a matter of practical suggestion, I venture to urge those who care to write well that they should re-write at least once, if not more often. Froude, in one of his essays, reminds his friends that everything he published was written and re-written at least five times! Before the stenographer and the copying press came into use, our fathers used to prepare a first draft, then carefully correct and amend it, and preserve it as their own record, sending a clean copy to their correspondent. Even twenty years ago mining engineers and geologists wrote their reports and descriptions in long hand, correcting as they proceeded and re-arranging their statements with great care, in contrast to the slap-dash ways of a fluent dictation that obviates all manual labor save the signature.

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## SPURIOUS COIN

The language of mining and metallurgy suffers from the introduction of terms that are provincial, colloquial, or plainly vulgar. The language of the stope has its use—in the stope; the phrases of the mill-foreman are not without their significance—in the mill; linguistic evolution advances in part, at least, by the adoption of words of lowly birth or even of those of illegitimate origin, but, if the exception be granted, there remains scant excuse for the employment of terms that come from the uneducated, seeing that we have the choice of synonyms that are the gift of scholars. When a college graduate prefers the colloquialisms of a working miner to the terminology current among scientific men, he is recreant to his training. To some among us the crudities of speech heard in mine and mill savor of the practical, and the exactness of the lecture room is suggestive of the theorist who does not soil his hands with labor or his clothes with grease. This is a pathetic fallacy. Yet it has its counterpart in journalism. Just as the mining engineer allows his speech to be modified by the talk of the laborers he employs, so the journalist is apt to allow his writing to be edited as to spelling, punctuation, and other supposedly minor matters, by the compositor who puts his writing into type. Until lately—and in places even now—the editing has been done chiefly by the compositors, not the editors, the latter performing all the sundry duties of their office except the one from which they derive their name. Once in a while a real editor, like Raymond, gives powers of rare quality to the improvement of technical writing, but

necessarily the benefit of his service is felt immediately only by those he is called upon to discipline, namely, the contributors to the transactions of the engineering society of which he has been secretary-editor so long and so successfully. For the rest, it is chaos.

The result is seen in the mongrel words that have invaded the language used by English-speaking engineers, geologists, and metallurgists. Take, for example, such words as **reef**, **paddock**, **ledge**, **sulphurets**, **gallows frame**, **leaser**, and so forth. Each of these ought to be taboo. **Reef** is Australian, it has been adopted in South Africa, and is now used by Englishmen everywhere. It is not needed, it means nothing that 'lode' or 'vein' does not signify, and if it conveys more it is misleading. The sailors and shepherds who started gold mining in Australia thought they saw a resemblance between the out-crops of quartz veins and the coral reefs or other ridges of rock that make navigation dangerous. Much the same notion is involved in the Californian use of **ledge**, although we have learnt long ago that veins of ore do not necessarily jut out at surface or protrude above the desert like the comb of a game cock.

Neither **ledge** nor **reef** is wanted; they ought to be kicked down the back-stairs of language by which they made a surreptitious entrance. **Paddock** is another Australian bastard; it means an enclosure for exercising horses, and the Australians, being keen horsemen, took to using the word in mining. Thus when ore is, or ought to be, 'in the bins', or 'stored', or 'stacked at surface', it is said to be 'in the paddock'. **Sulphurets** belongs to the Pacific Coast and is still employed by persons who ought to know better. It signifies the concentrated pyrite, such as

is separated on a vanner. Originally it referred to the sooty oxy-sulphides found at the bottom of the zone of oxidation. In this sense it was used by some scientific men, but it has lost all such special meaning and is now only a provincialism of the least desirable kind.

**Gallows frame** is usually pronounced, and sometimes written, **gallas frame**, as if to obscure its unpleasant suggestiveness. Certainly it gives no hint of the lofty engineering structure that stands over the deep shaft of a metal mine. To speak of a towering network of latticed steel as a **gallows frame** is plainly absurd, yet that is done at Butte and Cripple Creek.\* Nor is it necessary; we have **head-frame**, even if we do not want the British **poppet heads**. **Leaser** is another Western colloquialism; it is employed in place of **lessee**, but as a matter of fact it is a variation from **lessor**. Thus we see how language is turned inside out, for **leaser** is employed to designate the man taking a lease from the owner of a mine, while as a matter of fact **leaser** means (see any dictionary) the man that grants the lease.

One more bungling term may be instanced, namely, **rock**, which is used among the copper mines of Lake Superior to designate **ore**. Not only do the Finns, the Hungarians, the Swedes, and the other folk ignorant of the English language, employ this term, but the graduates from Columbia, Harvard, and Yale accept the sloppy usage. **Ore** and **rock** all over the world—except in Michigan—are set in opposition as signifying, respectively, the profitable and the unprofitable product of a mine.

These localisms may seem harmless enough, but they

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\*Incidentally it may be mentioned that **derrick** is derived from **Derrick**, the **hangman**.

are not; they restrict the usefulness of technical literature. The American does not know the meaning of **pad-dock** or **reef**, or reads into them a significance that they do not possess; the miner or engineer in Australia and South Africa misinterprets **gallows frame**, **ledge**, and **sul-phurets**. The educated man anywhere is misled by the employment of **leaser** and **rock**. Scores of similar examples are available, but they need not be recited; they are wearisome in themselves and in the iteration of them. There is a broader reason for objecting to all such provincialisms and insularities. The English language is the common heritage of the people of not one mining district, nor one region, nor one country, nor one continent; it is the heritage of the race to which Britishers, Americans, Canadians, Australians, and Afrikanders all belong, and also of the various races that they have assimilated in the course of their effort to conquer nature the world over. The mere fact that a word is distinctively Western Australian or Californian, is peculiar to Michigan or New Zealand, is reason enough for rejecting it. Let us have a mintage that will pass current at full value throughout the English-speaking world; let it be the refined gold of human speech.

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## ABBREVIATIONS

Since an abbreviation lacks dignity, it should not be used at the close of a paragraph and it ought to be avoided even at the end of a sentence. A paragraph embodying a reasoned statement should close with a word that is significant. In oratory, and even in lesser forms of speech, it is natural to end a statement with a word of some consequence. You do not "hit the nail on the head" with a cucumber, and you cannot expect to make a statement incisive with a final word that is of no value in the expression of your idea. It is this feeling of appropriateness that causes the speaker to close an oration with a sentence, and the sentence with a word, that is deeply significant. Literature is speech transferred to paper. Similar considerations govern the employment of language in either case.

The plural is not given to an abbreviation, because it is not a word but a symbol. In some instances the symbol used as an abbreviation refers to an entirely different word. Thus the term **pound** is represented by **lb.**, which stands for the Latin *libra*, and the plural of *libra* would be *librae*, not *libras*, therefore *lbs.* is entirely incorrect. **Oz.** is obviously not a direct abbreviation for **ounce** but the apothecary's symbol of that measure, therefore the plural is as improper as it would be if given to a chemical symbol, which is usually not a part of the common name of the element it represents. Thus **Au** and **Ag** are not abbreviations of 'gold' and 'silver' but symbols made from letters occurring in the Latin equivalents.

In the metric system we have to note that **cubic centi-**

**metre** consists of two words, therefore the chemist's abbreviation **c.c.** should be written with a period after each letter. Some of the chemical societies authorize the use of the form **cc.** but for this there is no excuse save laziness; if the first period is omitted for convenience, the second might as well be dropped and chemists who do not care to bother about niceties should use **cc** as the symbol of their literary independence. Colloquially most of us speak of a **kilo** of silver and when we are in a country using the metric system we talk about **kilos**. The last is a vulgarism; as for the singular form, that is apt in printed matter to be confused with **kilometre**. **Kilo** is an unscholarly abbreviation; it is better to use **kg.** for the **kilogram** and **km.** for the **kilometre**.

In regard to the **dollar** as used in Spanish-American countries, especially Mexico, most mining engineers and travelers know what confusion is created by using the same term for two different currencies, for a Mexican dollar happens now, but not always, to be worth about one-half of the American dollar, as measured in gold. It will be well to use the **peso** and **centavo**, instead of the **dollar** and **cent**, when referring to Mexican currency. The **centavo** is abbreviated to **cv.** and the **peso** is represented by the letter **P** with two bars, like those of the dollar sign; thus: **₱.** This is used in the Philippine Islands.

The half-spelling of the thermometrical signs (Fahr., Cent., Reau.) is ugly and unnecessary, as no two of them begin with the same letter. The initial serves the purpose, with the addition of a period.

Many writers appear to have a confused idea that **H<sub>2</sub>O** and **Aq.** are equal and interchangeable. The first is the symbol of a chemical entity; the second is the apothec-

cary's sign for water as a fluid; one indicates a molecule, the other water as a sensible mass or bulk.

The use of the upper accents to indicate **feet** and **inches** is objectionable, for it is also employed to indicate minutes and seconds; in practice the use of these signs is apt to cause errors, for the omission of one of the accents converts inches into feet. Even in giving a measurement of time it is better to use the verbal abbreviation of **minute** and **second**. Thus: 25 min. 17 sec., unless preceded by degrees, in which case confusion is unlikely and uniformity requires us to write  $35^{\circ} 25' 17''$ .

In giving measurements it is better to indicate the multiplication by the word 'by' than by the sign  $\times$ , because the first represents the wording as read and the latter, if carelessly written, is easily mistaken for the **plus** sign.

**Per cent** has ceased to be an abbreviation, for we no longer say **per centum**. It does not need a period.

Thus we arrive at the following rules:

1. Never end a paragraph with an abbreviation. Spell the last word.

2. Abbreviations are used in the singular only. Thus: 17 lb., not 17 lbs.; 15 oz., not 15 ozs.; 11 in., not 11 ins.

3. A period is required after an abbreviation. Thus: The Zinc Corporation Ltd.; the Mysore Gold Mining Co.; 40 ft. long; 11 in. wide.

4. Chemical symbols are not abbreviations, but signs. They do not require a period. Thus:



5. Weights and measures are abbreviated only when preceded by a number. Thus: 20 lb.; several pounds; five pounds.

6. The following abbreviations are noteworthy:

Barrel	bbl.	Gallon	gal.
Bushel	bu.	Horse-power	hp.
Fathom	fm.	Yard	yd.

Miles, tons, and volts are not abbreviated.

7. In metric measurements the recognized abbreviations are:

Metre	m.	Gram	gm.
Kilometre	km.	Kilogram	kg.
Centimetre	cm.	Milligram	mg.
Millimetre	mm.	Cubic centimetre	c.c.

The metric **gram** and the English **grain** must be spelled whenever there is a chance of confusion; otherwise use **gm.** for **gram** and **gr.** for **grain**.

8. In referring to money, the dollar sign should not be used for Mexican currency, but that of the peso, thus, **P.** The following abbreviations are correct:

Cent	c.	Shilling	s.
Centavo	cv.	Penny	d.
Franc	fr.	Florin	fl.

In the case of foreign money, it is usually best to spell words designating currency if there is any chance of a misunderstanding.

9. In abbreviating the thermometrical and chemical scales, use the following:

Centigrade	C.	Beaumé	B.
Fahrenheit	F.	Réaumur	R.

10. The words **figure** and **number** are abbreviated when preceding a numeral. Thus: "There is a diagram of No. 2 shaft in Fig. 3."

11. The word **company** is abbreviated when part of an official name. Thus: The Camp Bird Mines Co. When used informally it must be spelled, as: "We understand that the Camp Bird company is to build a new mill." The **and** forming part of the name of a company is written with the ampersand. Thus: The Butte & Boston Copper Mining Co.; the Denver & Rio Grande Railroad.

12. Use abbreviations, not signs, to indicate feet and inches or minutes and seconds. Thus: 14 ft. 3 in., not 14' 3''. Also 34 min. 5 sec., not 34' 5'', unless preceded by degrees; then 10° 34' 5''.

13. Use the word 'by' instead of the sign  $\times$  in giving dimensions. Thus 8 by 12 in., not  $8 \times 12$  inches. Also: 12 divided by 3, making 4 ft., not  $12 \div 3 = 4$  ft., except in mathematical tables or treatises.

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## NUMBERS

In making rules for the use of numbers it is necessary to recognize the exceptions. The styles of different printers exhibit an amusing diversity and the attempt to observe any cast-iron rule will lead to trouble.

While it is usual to spell numbers less than 10, because they are represented by short words, it is desirable to use figures even for numbers less than 10 when they are grouped with other numbers of 10 and over. Thus: "The length in one case was 2 ft., and in the other it was 11 ft." This puts the two figures in better contrast than by saying: "The length in one case was two feet, and in the other it was 11 ft." Similarly, when weights or measurements are being compared. Thus: "The timbers used were 2 by 4 by 12 inches" or "one vat was 8 ft. deep and 6 ft. diam., while the other was 10 ft. deep and 8 ft. diameter." The figures emphasize the idea of relation of size better than if the dimensions were expressed in words.

Figures indicate some attempt to be accurate, so that when a mere approximation is intended it is well to avoid the use of them. Thus: "He lived here twenty years ago," if it was about twenty years ago; but if it was exactly 20 years, then employ the figures.

Three shades of accuracy are expressed by ten, 10, and 10.0. Ten is approximate, 10 is accurate, 10.0 is exact. The last form is used only in connection with other decimals. For example: "One streak of ore is 8.4 in. wide, another is 9.3 in., and a third 10.0"; meaning thereby that the possibility of a slight excess or deduc-

tion from 10 has been considered, and rejected, the measurement being absolute.

The use of unnecessary ciphers is apt to cause an error by misplacing the decimal point. Thus \$5.00 may be made \$500 by the dropping of the point. It is obvious that \$5.00 offers no advantage over \$5; it is calculated to mislead, for the extra ciphers make it loom larger than the single figure. People who offer rewards for missing poodles do well to state that they are prepared to pay \$1.00 for the lost dog, for \$1.00 looks like more money than \$1, which seems little enough for a valuable puppy.

In regard to the use of the comma, it is customary to employ it for the thousands, but this is not necessary and divides the figures unpleasantly; therefore, it is well to write 5000 and 2500 rather than 5,000 and 2,500, using the comma at the next stage. Thus: 5000, not 5,000; but 51,250, not 51250.

As to decimals I venture to advise technical men to employ them whenever they mean to be exact and whenever they have the information permitting of such exactness, reserving the employment of fractions for approximate statements. Thus: "The ore carries 2.25 (not  $2\frac{1}{4}$ ) oz. gold and 10.75 (not  $10\frac{3}{4}$ ) oz. silver per ton," if an assay has proved this to be the case. It is best to say, "The distance is  $2\frac{1}{2}$  miles" when all you know is that it is more than 2, and less than 3, miles. If the distance has been measured and it is known to be exactly 2.5 miles, the decimal is preferable. Do not make a pretense of accuracy by using decimals when they are not wanted.

Hours or minutes less than 10 should be spelled (two hours) unless grouped with figures of 10 and over (12 hr.) or with a decimal (as 1.5 hr.). 'One and five-tenths

hours' is preferably not spelled, because it spreads too much and is clumsy.

There is another exception: I refer to dimensions such as eighth, sixteenth, or thirty-second, which are used in mechanical engineering, where tools and appliances are made in fractions of an inch. To say 0.125 in. or 0.03125 in. will not convey what is meant, because the fractions refer to standard sizes quoted in the trade, and not actual measurements. A quarter-inch plate is not necessarily exactly 0.25 in. thick.

The foregoing ideas are embodied in the following rules:

1. Use figures for 10 and for numbers over 10. Spell those under 10.

The following exceptions must be noted:

(a) When beginning a sentence, as: "Fourteen men working six days completed the dam."

(b) When there are several references to numbers, so that the figures accentuate the statement of fact. "Nine men working 6 days with machine-drills were able to sink the shaft 9 ft., breaking 75 tons of ore."

(c) When one number follows another, spell one of them, preferably the smaller: "He took samples at 50 five-foot intervals." "The manager bought eleven 24-ft. belts."

(d) When an approximation is intended. Thus: "This was a lively mining camp twenty years ago." "He will be a rich man ten years hence."

2. Omit unnecessary ciphers in stating sums of money. Thus: \$2, not \$2.00; \$5000, not \$5,000.00.

3. Use the comma for more than four figures, not otherwise. Thus: 5000 and 50,000.

4. Use decimals in place of fractions whenever you mean to be exact, not otherwise.
  5. In decimal numbers having no units, a cipher should be placed before the decimal point. Thus: Not .32 lb., but 0.32 pound.
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Usage determines the meaning of words. In the end a word gets to mean what people in general intend it to mean. When you violate good use, you employ the word in a sense likely to be misunderstood, and then the word becomes either a blank or a snare. The Western American who speaks of doing the work of a 'mucker' in a mine is unintelligible to the Australian, and the New Zealander who talks of putting ore in a 'paddock' is offering not information, but a riddle, to the Canadian. The use of spurious words or the colloquial jargon of the illiterate tends to take us back to the monkey stage, for man's chief distinction from the lower animals is his gift of intelligent and intelligible speech.

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Technical words are designed for a specific purpose, as tools are kept apart for special duties. It is a mistake to open a can of sardines with a chisel. Such use blunts the chisel and destroys its service in carpentering. The significance of words intended for special uses is impaired when they are made to do a common service, for which other words are available.

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## THE MATTER OF EDUCATION

Technical men, such as engineers and geologists, are not always graduates from a university, nor, even if they happen to have received a liberal education, are they necessarily well trained in the use of the English language—that is, the training founded upon lessons in the languages of antiquity, followed by familiarity with the classics of their own tongue. Undoubtedly such a preparation is useful, but the value of it can be over-estimated. Not long ago a mining engineer, who occasionally contributes to technical journals, took pains to explain to me that he was not a college man, as if to excuse the lack of finish in his writing. It seems worth while to dwell on this point, in order to encourage those who have both knowledge and ability to write intelligently, without the aid of previous teaching either in Greek and Latin or in Milton and Meredith. To be taught a language systematically is like any other form of mental training, it is a short-cut to efficiency, enabling the student to acquire, rapidly and thoroughly, such skill as would otherwise be attained only laboriously and imperfectly. Nevertheless, there are those that have taught themselves, by practice and association, whether of men or books, to write well the language of foreign lands or of their own; on the other hand, there are many owners of a university diploma that have so skillfully evaded instruction in the proper use of their own language, not to mention a foreign tongue, that they are, to all intents and purposes, illiterate. The modest fellow who excused himself to me, on the occasion above mentioned, had learned to write in a

straight-forward unpretentious way, which in itself constituted the style best adapted to technology. He might lack the classical learning required of a man competent to undertake the preparation of a 'Synthetic Philosophy' or 'The Decline and Fall of the Roman Empire', or an 'Essay on Criticism', but for the purpose in hand, namely, to describe an ore deposit or discuss a problem in metallurgy, he was adequately equipped. Rhetorical confectionery and frills of any kind are out of place in technical writing, except on rare occasions. The sort of self-consciousness that leads to verbal gymnastics is in itself bad form, and it is affected only by the half-educated. There is the simplicity of diction marking the man acquainted with several languages and the master of at least one of them; and there is the simplicity of unpretentious speech belonging to the man who has but a working knowledge of his own language, and makes the most of the instrument at his command. Between them comes the writer who ought to know better, but, from conceit or ignorance, deems it a waste of energy to use his verbal weapons so that they shape his thoughts into carven words, whether vitalized in the speech of the moment or sculptured in the writing that lives.

Two examples, founded on fact, will illustrate my argument. I had the pleasure of editing a long and detailed article describing the operations of a metallurgical process; there was no room for a literary pose, for the whole account was eminently practical and businesslike. This article was so well written as to require scarcely any editing, and when it was published I referred gratefully to the excellence of the writing. Happening to discuss the incident with a friend, who knew the writer of the article

personally—as I did not, this common friend asked me to guess for what occupation the writer had been trained, and I answered: “The ministry.” This happened to be exactly right, for he had been to Oxford and was intended for the Church before he wandered into a cyanide mill. All the marks were there, such as a quiet command of English and a masterful use of it, making a difficult bit of technical exposition as clear and interesting as the subject permitted. And since “the home of lost causes” is not my alma mater, I am glad to acknowledge the value of Oxonian English in the literature of science. More of it would be a great relief to the readers—not to mention the hard-working editors—of technical periodicals.

My other example is less different than, at first sight, it may appear. I have in mind an article describing mining conditions in a Central American republic. Such descriptions are usually made as verbally florid as the vegetation of the tropics, and they are frequently as involved as the jungle itself; at the best, it is customary to bespatter them with unnecessary Spanish words and to deal in gorgeous generalities supposed to indicate the unlimited mineral resources of an inaccessible region. From all these common faults, this article was free. The sentences were short and to the point. The statements conveyed information and yet avoided exaggeration. The writer kept what he knew at first hand separate from what he had merely been told; he gave just the data the average intelligent reader would be likely to want, and a touch of humor was not lacking in a reference to the queer things that happen on the Spanish-American frontier. It was like the sensible talk of an intelligent traveler who had kept his eyes open and his notebook handy.

The writer had received no special training in his own language, nor in that of another; as the graduate of a technical college he had been given rather more of contempt than love for the use of proper words in proper places, and yet, by native intelligence and the desire to do his task well—his task being to tell what he knew of mining in this particular region—he had succeeded in preparing a contribution that was in its way as good as that of the Oxford man. Both men were unaffected, both kept in mind the purpose of the writing, and both knew what they were talking about. The moral of it all is that bad writing is due either to insincerity, or carelessness, or ignorance.

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## HYPHENS

Hyphens may be considered ungainly, but they are necessities in technical writing, where materials and machinery are continually being described under conditions modifying each other. There is a varying degree of intimacy between adjacent words. This is expressed in three ways:

1. Mere juxtaposition of separate words, indicating a loose connection.
2. Hyphenation, implying intimacy without entire loss of individuality.
3. Compounds, expressing a singleness of meaning.

Thus: An 'ore deposit' is a deposit of ore, and you can drive a cross-cut to find either the **deposit** or the **ore**. Moreover, a **deposit** is not necessarily composed of ore; it may consist of mud or guano. Likewise the **ore** may not be in the form of a deposit; it may be in a mill-bin, or in a furnace. In the case of an 'ore-shoot' there is a duality, but not a separateness, of meaning, and while the **shoot** may be mentioned by itself the idea of **ore** is assumed, this intimacy being recognized by hyphenation. Finally, in 'orebody', we have a true compound, for the miner does not drive his drift to discover some indeterminate kind of **body**, nor does he say that the **body** is large or rich; he speaks of **orebody** as signifying one idea, the separate portions of which, the body (substance) and the ore (attributive), are completely merged in the notion of a mass of valuable rock, constituting an orebody. Another example may be given, thus:

A **blackbird cage** is a cage for the songster known as the **blackbird**.

**A black-bird cage** is a cage for birds that are black.

**A black bird-cage** is a black cage for birds.

**A black bird cage** might mean a black cage for birds, or a cage for black birds, or a cage for blackbirds. Unless two of the three words are hyphenated or compounded, the meaning remains unknown. Further examples referring to technical subjects will make clear the service done by hyphens.

**A single-stamp mill** is one possessing batteries of one stamp apiece, like the Nissen, instead of the usual five.

**A single stamp-mill** is a lonely mill, like some to be seen in the deserts of Nevada.

**A single-stamp-mill** possesses only one stamp, after the Lake Superior fashion, where one big steam-stamp does the work of 150 ordinary gravity stamps.

**A crude ore-bin** is an ore-bin of crude construction; a **crude-ore bin** is one made to contain crude ore, that is, ore as it comes from the mine, before concentration in the mill; a **crude ore bin** is an example of crude writing.

In the manufacture of nitro-glycerine the charge is 'drowned' in a large volume of cold water; the receptacle in which this is done is termed the 'drowning-tank'. Should the hyphen be omitted, it might be supposed that the tank was drowning and sympathy would be needlessly excited. Similar examples are **cooling-floor**, **roasting-hearth**, **grinding-plate**, **settling-vat**, **amalgamating-pan**, and so forth.

The first part of these compound words is a gerund; that is, it is a verbal noun identical in form with the participle; the participle is an adjective, but the gerund is a noun that has the power to govern another noun. For example: **A cooling floor** is one that, having been hot,

is becoming cold. Here **cooling** is a participle serving as an adjective. A **cooling-floor** is a floor upon which hot ore is placed for the purpose of cooling; in other words, it is a floor employed for cooling ore. Here **cooling** is a gerund, doing duty as a noun.

Hyphenation is necessary to prevent ambiguity. Thus a **settling-vat** is a vat in which particles of ore are likely to settle, but a **settling vat** is one that is subsiding, for example, by reason of a landslip or bad foundation. A **zinc box** is made of zinc, but a **zinc-box** contains zinc; for example, the compartments in which zinc is placed in order to precipitate gold from cyanide solutions. These boxes are **precipitating-boxes**, not **precipitating boxes**, because they do not precipitate the gold, they merely afford the facilities for the precipitation. A slag-pot receives slag; it is not made of slag, as is a slag pile.

The following quotation vividly illustrates the value of the hyphen: “**Iron screens in zinc boxes** are detrimental in as much as they facilitate solution of zinc.” The screens are made of iron and they are placed in wooden boxes, into which zinc shaving also is introduced; the boxes are not made of zinc, although the sentence says so. It ought to read: “**Iron screens in zinc-boxes** are detrimental because they facilitate the solution of zinc.”

A **roasting-furnace** is one in which ore is roasted. The furnace does not do the roasting, but the fuel that is in it. A **roasting furnace** is one that is being consumed by excessive heat, as in a conflagration. A **grinding plate** is one that grinds, but usually it is a **grinding-plate**, that is, a piece of steel or iron by the medium of which the ore is ground against another hard surface. It is a plate for **grinding**. Likewise an **amalgamating-pan** is one in which

the process of amalgamation or combination with mercury is effected; it is not the pan that does the work; it only provides the receptacle in which the action takes place. If it were the active agent, as sometimes the iron is actually supposed to be in the chemistry of the process, then indeed it would be correct to call it an **amalgamating pan**, without hyphenation. Familiar examples are carving-knife, walking-stick, and chewing-gum.

“Brown agitating tank.” This might suggest that a **tank** that was **brown** in color was being **agitated**. Each word needs amendment. On reading the context, the reader could ascertain that it was not a **tank** but a **vat**, for cyanidation; it was a **vat** in which the solution was **agitated**; it was the invention of **Brown**. Therefore, the title should be Brown’s agitating-vat (that is, vat for agitating) or agitator-vat.

Between true nouns the hyphen may be needed to mark intimacy between words. Thus: “The gases are taken into steel dust chambers where a large proportion of the flue dust is settled.” A hyphen is needed after the first **dust**, otherwise it may be chambers containing steel-dust, and not dust-chambers made of steel, as is meant. **Flue dust** also requires hyphenation; the dust does not consist of flues.

A **wet-milling plant** is one in which a wet process is employed, while a **wet milling-plant** is a mill in which water is wasted; it is a sloppy establishment.

In some cases the hyphen is needed to prevent confusion or to give emphasis to the meaning of the prefix **re**, as in:

**Re-treat** (to treat over again), which might be mistaken for **retreat** (to retire).

**Reconstruct** is equivalent to rebuild but **re-construct** goes a little further, as if to say that it is being built all over again. Thus: **reconstruct** a company, but **re-construct** a mill. Before a word beginning with a vowel a hyphen is especially desirable, as in **re-ignite**, **re-imburse**, **re-incorporate**. The prefix **re** is given with varying emphasis, as in **relegate** and **re-locate**; in the latter the idea of repetition of the act of locating is strong, therefore we write **re-locate** and not 'relocate'. In **co-operate** and **co-ordinate** the hyphen takes the place of a dieresis. **Reinforce** is written without a hyphen, the significance of the **re** having become lost.

It is easy to **re-cover** an umbrella that is in need of repair; it is most difficult to **recover** a lost umbrella, especially if it be a good one.

A man is **downcast** in spirit, but a shaft is **down-cast** as regards ventilation.

Between numbers expressing a range of measure or quantity, it is well to avoid using a hyphen. Thus: "The addition of 5-7 c.c. of preventive solution" is improved by writing "5 to 7 c.c.," for a dash in the manuscript might be taken for a period; in reading we say "to," therefore it is well to write it.

The **fifty-first** means the one coming after fifty, but the **fifty first** are the fifty that come first, or the first fifty.

The hyphen is not needed between adjectives, as **light blue**, **yellowish green**, where the first plays the part of an adverb. In **blue-black** it seems unavoidable.

Between an adverb and a participle (even in an adjectival form) the hyphen is not required, thus: **well defined**, **finely developed**.

Two nouns should be hyphenated if they are brought

together to name one thing and neither of them is used distinctively in the adjectival sense. Such compounds are elliptical condensations of a phrase, and the normal sequence of the words is inverted. Thus we have **freight-train** (train for freight), **foot-note** (note at the foot), **field-work** (work in the field).

Two words grouped in an attributive position seem to be welded together, but when they are in the predicate they appear to have an independent meaning. The attributive group is hyphenated, while the predicate is not; in the predicate the adverb is stronger, thus:

1. "I followed the half-obliterated footsteps."
2. "The footsteps were half obliterated."

Of course, hyphenation can be carried too far, and it has been abused even by good writers for the reason among others, that they have developed the habit from familiarity with German, a language in which compounding is carried to a distressing extreme. Thus we read:

1. "The supply of lead-ore at any particular plant."
2. "These magnetite-deposits are associated with gneisses."
3. "The nickel in an iron-ore would be of value."
4. "Decrease in the residual sulphur-values, indicating a greater sulphur-removal."
5. "The use of mining-machinery during a period of five years."
6. "Comparatively few bituminous coal-mines can be equipped."
7. "The several makes to-day differ only in details."
8. "Under every-day working-conditions."

These examples are taken from a few pages of Vol. XXIX, of the Transactions of the American Institute of

Mining Engineers. In most instances the hyphens are not needed, for they do not make the meaning clearer; they are not regrettable necessities, but avoidable disfigurements. In several cases the use of them can be set aside advantagously, for "these deposits of magnetite" is preferable to "these magnetite deposits." In the fourth example, the hyphen is awkward. In the fifth it seems wholly unnecessary. In the sixth, it is not the **mines** but the **coal** that is **bituminous**, therefore it ought to be **bituminous-coal mines**. **To-day** does not need a hyphen; it is a compound so familiar as to have attained the meaning of a single word. In the last example we have a Germanized construction that is expressive but awkward; there is nothing gained and something lost by the use of the hyphens. It is well to make technical writing as attractive as the subject will permit.

Hyphenation represents an early stage of union. After a while, by use, the association of ideas becomes fixed, so that the pair of words is wedded, forming a literary unit. The chief reason for hyphenation of two words is that when so connected they have a meaning slightly different from that which they convey when given separately. But it will not do to lean too heavily on the hyphen; illustrations of distinctions can be given, as above, but in practice it is well to avoid all risk of confusion. In speaking there is a variation of pronunciation between the members of a hyphenated couple, affording a subtle distinction not transferable to written language. **In writing, the desire to be lucid should be the controlling factor.**

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## SOME WORDS AND THEIR WAYS

The description of metallurgical processes and the explanation of technical methods, whether in mine or mill, will be rendered clearer, and therefore more useful, by the selection of the right words.

**Vat** and **tank** are used as synonyms, **tank** having come into general use in connection with cyanide work. This is unfortunate. A **tank** is a large vessel or receptacle, made either of wood or of metal, intended to contain a fluid, such as gas or water. 'Water tank' and 'gasoline tank' represent correct usage. The transfer of the word to chemistry is not warranted. For that purpose we have **vat**, that is, a vessel or tub in which ore is washed or subjected to chemical treatment. 'Cyanide vat' and 'chlorination vat' are correct. Because illiterate and non-technical people use technical terms wrongly, engineers are not justified in adopting sloppy ways of speech.

**Ledge**, **reef**, and **lead** afford examples of the same kind. **Ledge** and **reef** are localisms, originating in California and Australia, based on early geological misconceptions of the nature of a 'lode' or 'vein'. **Ledge** refers to the prominence of the outcrop and **reef** to the projecting edge, resembling the rocks that endanger navigation. There is no need of these terms now. In so far as they have a special significance, it is misleading. As to **lead**, it is a good old term, for it is allied to 'lode' and indicates the meaning of the latter, as something that leads the miner in his exploration, but the term is now applied exclusively to gravel deposits, as in 'deep lead', which is an alluvial channel blanketed by lava. **Lead** should not be used as a synonym for 'vein' or 'lode'.

**Sulphuret** is rarely used nowadays save on the Pacific Coast. It is a term that some people who ought to know better use in place of 'sulphide'. **Sulphuret** was used at one time to designate the earthy sulphates formed in the early stages of oxidation of sulphides, but this distinction is no longer observed and the term is now a mere localism, without special meaning. 'Concentrate' and 'sulphide' are preferable.

The use of the term **country-rock** amounts to tautology, as was pointed out by Le Neve Foster many years ago. If we could agree to use **country** by itself, it would be well. Obviously it must be **rock**, although we read sometime ago in a Colorado paper of a drift that was "in no formation," meaning thereby that it was in rock of no definite structure. The workings of a mine cannot penetrate anything but rock, unless it be a snow-drift, as happened once in the case of some crafty contractors, who closely timbered 50 ft. of an adit that went through a snowslide before it became a bore in a granite mountain.

**Vein-stone** is a similar survival from the days when mining literature was written for people that were not supposed to know anything about such matters. And thus we come to Australian usage, which is derived from untechnical sources. At Bendigo and Ballarat they talk of "good-looking **stone**," meaning 'ore'; of "a make of **stone**," meaning an 'ore-shoot'; they strike "rich gold" in a shaft and find "poor gold" in a cross-cut, meaning quartz rich or poor in gold. These terms appear even in Australian mine reports that are prepared by educated men, who simply get their terminology from illiterate workmen.

Fully as bad is the usage obtaining in the Lake Supe-

rior copper mines, where they exploit **copper rock** and obtain **mineral**. For the use of **rock** instead of 'ore' there is no excuse whatever; for **mineral**, meaning the native copper extracted by milling, there is some reason, for is it not *the mineral* in that region? It is a localism that has become rooted by repetition. But no self-respecting engineer ought to use **rock** in the Keweenaw way.

Then there is **mineralization**, to which some object. It comes to us from the French, who will say that an ore is *bien mineralisé*, just as we (with an apology) may say that it is 'well mineralized'. *Minerai* is French for 'ore' and *mineralisé* is employed as the corresponding adjective, despite its derivation from *mineral*. When we use 'mineralized' and 'mineralization', we mean that the rock is full of the valuable minerals that constitute, or else accompany, ore, but as we do not hark back to *minerai*, our use of these English terms is not academic. However, in default of better terms, **mineralized** and **mineralization** are acceptable.

In Australia they call a level in a mine a **drive**, and this is the custom among Englishmen generally. In America they say **drift**, and this is correct. A miner **drives** his working ahead and the result is a **drift**. For example, it is correct to say:

1. "Ten feet of driving was accomplished."
2. "The north drift was advanced five feet."
3. "The lessees drove the drift as rapidly as possible."

Similarly, in regard to another form of mine working, the result of excavating upward is a **raise** or **rise**, the latter preferably. It should never be **upraise**, as some-

times appears in reports on mines. **Down-winze** would be no worse.

It is unfortunate that in so good a book as Le Neve Foster's 'Textbook of Stone and Ore Mining' he should have given **chute** as the American equivalent of 'ore-shoot'—which it is not. The employment of **chute** instead of **shoot** to describe an orebody of definite shape and pitch is now a British error, for it is rare in America. An error it is. **Chute** is a mode of spelling 'shute', which is an inclined trough for conveying materials. Thus:

"The ore broken from the new ore-shoot passes down the chute that leads to the mill."

The distinction, now fairly well established, between these two terms is worthy of general adoption among English-speaking technical men.

**Tunnel** is commonly employed to designate a drift or level penetrating a hillside; this is wrong, for a 'tunnel' is a gallery or bore that goes *through* a mountain from daylight to daylight, as a railroad 'tunnel' does. The long cross-cut or drift that enters from the surface, becoming the main artery of the mine, serving both as an exit and to drain the workings, may best be labeled an **adit**, which is a good old technical word long known to miners. On the other hand, the short drifts or levels that are run by prospectors into the hillsides of our mining regions, and which cannot well be called by so big a name as adit, need not be called **tunnels**, seeing that 'prospecting drift' or 'exploratory level' or plain **drift** or **level** will serve for the purpose. The French have *galerie* and we sometimes use the English equivalent, but it has become archaic.

When words have a prescribed duty to perform in

technology, it is well to limit their use to a particular meaning. Thus **locate** and **location** are employed in mining to signify, respectively, the act of delimiting a claim and the claim when thus delimited. It is a common error to use **locate** instead of **place**, **situate**, **reside**, **find**, etc., as in the following examples:

1. "The company located the mill on the side of Gold hill."
2. "The town is located on Alder creek."
3. "He was located at Tonopah."
4. "The superintendent located the ore-shoot at the fourth level."
5. "Where the office, quarters for men, and ore-bins are to be located."

In the first it would be right to say that the millsite was **located** at a certain place, but the building itself was **built**, or erected there. The second case is common; the town is **situated**, although the townsite might be **located**, on the creek. The third is an ugly colloquialism. It should be: "He **resided** at Tonopah," or plainly, "he **lived**" there. In the fourth, the writer means that the position of the ore-shoot was ascertained, or briefly, that "the superintendent **found** the ore-shoot." In the fifth, **built** will state the meaning.

6. "Ore has been found on four new locations on the property." He does not mean what he says, for he states that ore has been found on four new claims (that have been located, but not patented). He means four new places or spots or points.

7. In one of the Geological Survey reports it is written: "In planning the position of stopes the assay charts often enable the location of pillars in relatively poor ma-

terial." This should read: "In platting the stopes the assay-charts often indicate the best position for pillars in the relatively poor lode-matter."

The last abomination in the way of making **locate** do improper service is that which I saw lately in a newspaper heading; it appears that a man had found his missing wife, and the fact was announced thus: "Locates his wife in Napa."

A test for the use of words is furnished by translating such sentences into a foreign language, when it will be noted that the translator will disregard the colloquialisms, finding it necessary to adopt the equivalents of the words that ought to have been employed.

**Section** is another word that, despite a specific meaning, is employed for sundry purposes. One would not use a pair of compasses as a fork nor a scalpel to cut bread. Precision of speech is required to express scientific ideas, and we lose such precision by making technical words do the chores of literary work. Here are some examples:

1. "The richest section of this mining district."
2. "They have as good a property as there is in that section of the camp."
3. "In the southern section of the State, they grow oranges."

In all these, **part** or **portion** is meant. **Section** means the view of something along an intersecting plane, as used in geology or drawing. As the subdivision of a township, another meaning has been established. These are enough; for other purposes we have other words. Even the American Association for the Advancement of Science might have spared the word from doing duty to designate the divisions into which the Association is separated for the

discussion of different subjects, so that there is a 'Section of Geology', another of Astronomy, and so forth. But it is too much to expect scientific men to make a study of the use of language; in that, they continue to be far behind people of lower intelligence.

The words **dip**, **hade**, and **pitch** are used confusedly. It will be well to apply **dip** to the inclination (from the horizontal) of strata, veins, and faults, rejecting **hade** as a term no longer necessary and only likely to make confusion, because it refers to the angle from the vertical. The angle made by an ore-shoot in the plane of the vein is its **pitch**; this also should be measured from the horizontal. Thus:

1. "The pitch of the apex of the saddles at Bendigo ranges from 10 to 30°, either north or south."
2. "The main orebody had a pitch of 80° southeast."

The word **slimer** is used by several manufacturers of machinery to describe a device for treating slime, by concentration of the valuable minerals in it. A **slimer** is a machine that *makes* slime; for example, a tube-mill. A **slime-table** is one that *treats* this mill-product.

"John Smith is manager of the Great Bullion Co." No, he is manager *for* the company, and manager *of* the mine. Similarly, he may be consulting engineer *to* the neighboring mining company.

Use **lessee**, not **leaser**; the latter is a mere vulgarism and apt to be confused with the **lessor**, who is on the opposite side of the fence. As explained elsewhere, **leaser** is really a variation of **lessor**.

"A partial history of the district indicates that, etc." Meaning a **part** history or an **incomplete** history or a

portion of the history, but not a prejudiced history, as might well be supposed.

“At times the ore is very rich.” Meaning, in **places**.

A curious example of the misuse of technical terms is afforded by Gilpin county, Colorado, where it has become the local habit to speak of the concentrate saved on shaking tables as ‘tailings’. It is literally a contradiction in terms.

**Value**.—The misuse of this word, and its plural, is a good example of a colloquialism harmless enough in a stope or in a mill, but a solecism in literature. It is also an instance of the employment of the abstract for the concrete, one of the primary blunders in poor writing. “This mill is intended to extract the values in the ore” is a vague way of saying that it is meant to extract the gold or lead or silver or the **valuable metals** in the ore. **Value** is the desirability or worth of a thing; it is an attribute, not a substance. A man that designs a concentrator to “catch the **values**,” might as well build a railroad to pursue a quadratic equation. Nevertheless, this vulgarism of the mining camp has crept into technical literature, and it can be found in articles otherwise well edited. Here are some examples:

1. “In sinking the **values** were lost.” Meaning that the ore became poor, or that the **valuable ore** ended.

2. “The vanner saved all the **values** in the ore.” Meaning, the **valuable minerals** that the ore contained, or all that was valuable in it.

3. “And then the gold **values** are precipitated on zinc shavings.” No, it is the **metallic gold** that is precipitated; you can precipitate a panic by reckless banking, but you

don't precipitate anything so vague as **values** on something so tangible as zinc shaving.

4. "In this region there are found ore deposits, principally with gold and copper **values**." Meaning, chiefly valuable for gold and copper.

5. "With the development of **values** in the quartz veins south of the Butte hill, there has been a scramble for claims." It would be better to say, "When it was proved that the quartz veins were valuable, etc."

6. "The mill will be used to test the copper **values** of the rock from the Nonesuch mine." Meaning, **the value of the ore** as regards copper, or its copper content.

7. "The gold **values** being largely free-milling." Here the objectionable word can be dropped entirely. It is the **metal** in its native state that is docile to treatment.

8. "Where cemented ground is handled, ample provision must be made for breaking up the gravel and separating the **values**." In the first place you do not break gravel *up* or *down*; here 'disintegrate' is meant. You do not separate the **values**, except on an accountant's page; here it is the gold and platinum that were separated from the matrix of gravel.

9. "The Broken Hill ore assays 16% lead, 15% zinc, and 11 oz. silver. Until a few years ago of these **values** only 65% of the lead and between 45 and 50% of the silver was saved." No values are stated. **Valuable metals** are indicated. By omitting "of these **values**," the statement will be made clearer.

10. "The ore carries \$150 per ton in **values**." This is clumsy. "The ore assays \$150 per ton" conveys all that is meant, for assays are not usually made for metals having no commercial value.

In many cases “the **values** in an ore” is used to express the profitable portion of it. Thus, someone “extracts the **values** by the cyanide process.” Again, it stands for the relative richness or grade; thus: “The **values** fell off soon after the mill was built,” meaning that the grade or tenor of the ore declined. The sentence as given is often a pathetic fact as well as sad grammar.

“The **values** are in the galena,” meaning that the gold or silver is closely associated with the galena, that is, to put it plainly, “the gold is with the galena.”

By dropping this misuse of **value** and **values** we shall clarify technical writing.

Much the same line of criticism can be followed in regard to the use of the term **strike**, as:

“The Cresson property reports a strike of high grade value from which shipments will be made.” This is full of colloquialisms. The property does not report anything, this is done by the superintendent or some other man in a position to know. **Property** is a pretentious synonym for mine. **Strike** is used in mining to indicate a discovery, and it is over-worked, for *The Evening Post* tells of **ore-strikes**, as if the miners might strike an ichthyosaurus; they would then strike for higher wages. It is a pity to make **strike** do double duty, for it tends to confusion. When you hear that there is “a strike at the Bullion mine,” you are left in doubt whether the men have abruptly cancelled their agreement to work or whether the miners have broken into a body of rich ore. **Strike** may well be reserved for the first of these meanings; for the other service we have many words and phrases, such as “cut an **orebody**,” “discovered **ore**,” “intersected a **vein**,” “broken into a **bonanza**,” “found rich **ore**,” “pene-

trated an ore-shoot," and so forth. The use of the verb as in "They struck ore," "He expects to strike oil," is preferable to the employment of the noun, as in "He made a strike," "There is news of a rich strike." Used thus it is a colloquialism, and while colloquialisms may by usage become legitimatized, it is safe to say that the only reason for employing them is the fact that they do the duty no other words can perform as well. If a colloquialism can be avoided, it should be; and if the colloquial use of a word makes for confusion by reason of other legitimate uses, it is well to forbear. **Strike** is the compass course of a line and is so used in mining, geology and surveying; that is its proper technical service. In economics, it signifies the rupture of relations between an employer and his employees. These two usages do not conflict; they suffice; let us not overwork our terms, lest they fail to carry our meaning.

Returning to the quotation: It was a "strike of high grade value," meaning a 'discovery' of rich ore or a 'find' of valuable ore. **High-grade** should be hyphenated. Then it is said that shipments will be made from "the strike of high grade value." This is an arithmetical exercise, for only in mathematics can you transfer high-grade values. The whole sentence, interpreted into plain English, means: "It is reported from the Cresson mine that rich ore has been found and that shipments will be made shortly." Of course, the shipments must be made soon; if not, the reference to shipments is unnecessary; ore once discovered is not supposed to lie in the ground indefinitely. So the statement may well be abbreviated to: "It is reported that rich ore has been found in the Cresson mine."

Orebodies and lodes are often described as **permanent**, meaning thereby **persistent** or **continuous**. For example:

1. "The ore deposit is of a **permanent** character."
2. "The officials of the company feel confident that it is a **permanent** vein."
3. "Gash veins are short-lived, but a true fissure vein is usually **permanent**."

The only way to make an orebody **permanent** is to leave it in the ground; the whole trend of mining is to destroy the permanence of aggregations of ore, to break them, to remove them, and to treat them so that a part, as bullion, goes to the mint or to the manufacturer, while the remainder disappears into the creek that receives the tailing from the mill or the slag from the smelter.

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The lack of a classical education leads many scientific men into vulgar blunders. For instance, in *Science*, the official organ of the cult in America, there appeared recently such statements as that "the underlying strata was a soft limestone," and that "this phenomena was closely observed by us," and that "we owe this data to the courtesy of Mr. \_\_\_\_\_. " No wonder that Professor Hilgard remarks that the restriction of the scientific curriculum to the limited language-study of the high-schools is yielding unfortunate results.

Sainte-Beuve said of Napoleon, and Matthew Arnold of General Grant, that clear-cut thinking is indispensable to the best writing.

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## UNCONSIDERED TRIFLES

**Very.**—This unpretentious little word is worked to death, like the donkeys of a mining camp, which are apt to be hidden under a big load of lumber or other supplies. Nine times out of ten **very** can be omitted without loss, because it serves only to increase the number of words.

**Very** pre-supposes a comparison. A four-story brick building is **very** large to those who live at Salmon City, Idaho, and it may there do glory to the name of a former senator, but it is as nothing to those who live among the 'sky-scrappers' of New York. A mine with a 1000-ft. shaft is **very** deep to the scribe who writes on the *Weekly Howl* in a new camp in southern Nevada, but it is shallow compared with the openings on the Comstock lode. A vein that is ten feet across is **very** wide as seen at Cripple Creek, but it is a thin seam to a man who is working in the Homestake mine. It is all a matter of comparison, and unless your reader knows your standard, the **very** possesses no significance.

When a man says that "the ore of the Great Wildeat Extended mine is **very** rich," it depends upon what his idea of rich ore happens to be. On the Mother Lode in California 15 dwt. ore is **very** rich; at Goldfield, in Nevada, such stuff is low-grade. If you do not know the writer's notion of richness, his **very** is wasted.

Or again, someone writes: "The district is **very** prosperous, there being many **very** rich mines, some of which are **very** deep and **very** extensive, so that there is a **very** good hope of **very** many years of **very** successful development." It is a debauch of emphasis, and all of it is

wasted unless you know the writer's standard of prosperity, richness, depth, extent, and so forth. Cut out each **very** and the sentence will lose nothing.

There is an air of exaggeration about statements burdened with a frequent **very**; on the contrary, there is a suggestion of moderation and assured knowledge in the descriptions that convey ideas of relation without a repeated lashing of that little word. Out of ten **verys**, nine can be dropped without affecting a statement, save to strengthen it.

Occasionally the effort to emphasize defeats itself, thus:

1. "This machine makes a **very** perfect separation of the mineral from the gangue."
2. "It is **very** obvious that the mine is well worth the price asked."

In both these cases the **very** weakens the force of the statement, instead of reinforcing it, for a **perfect** separation cannot be bettered; it is apparent that if the writer means anything, he means that the separation is *almost* perfect. In the second case, a thing is **obvious** or it is not; it can neither be *more* obvious nor *almost* obvious; from the unnecessary emphasis we are led to suspect that it was *not* wholly obvious that "the mine was well worth the price."

When a nurse tells a fairy story to a child, she will use many **verys**, which fall on the imagination of the child like a hailstorm on a flower-bed. The excessive use of **very** is childish; it makes a constant call for exaggeration. It becomes wearisome. If the reader will apply the test to the average writing of the day, he will find

that little is lost by omitting **very**, and much, though *not* 'very much', may be gained thereby.

Other adjectives that are bullied in the same way by redundant adverbs are **straight**, **vertical**, **unique**.

"A very straight tunnel into the mountain."

"The vein is very vertical."

"A very unique child, said I."

"A rather unique gathering of our profession."

A thing is either **unique** or it is not, there is no degree of uniqueness. So also a thing is **vertical** or it is not; it is **straight** or it is crooked. Fortunately, there are a few words the meaning of which is unassailable.

**Doubtless**, **without doubt**, and **undoubtedly** are often used incorrectly as the equivalent of 'perhaps' or 'probably.'

"Doubtless the ore will be found again by sinking deeper."

"Undoubtedly the coming season will afford a better supply of water."

Here **doubtless** and **undoubtedly** are used in an apologetic way, and suggest anything but positiveness of belief. In both cases uncertainty must necessarily prevail. Thus the meaning of useful words is undermined. Another awkward locution is exemplified by "**There is no doubt but that** the lode is stronger in depth," in which case **undoubtedly** might be employed to advantage.

**Somewhat** and **Probably**.—"Anyone who hopes to write well had better begin by abjuring **somewhat**." So say the authors of 'The King's English'. It will also be well for writers to deny themselves the frequent use of qualifying adverbs, such as **perhaps**, **about**, **probably**, and

**rather.** As has been said by an authority, this "intemperate orgy of moderation" amounts to a disease, especially among British writers.

1. "A sampling plant was built **perhaps** five years ago."
2. "A **somewhat** important development is announced from El Oro."
3. "The designs for an installation of any **considerable** magnitude should not be approved until," and so forth.
4. "The lode is **probably** about ten feet wide."
5. "The quartz is **rather** hard and the walls are **very** straight."
6. "He uses a solution of **about** 2 per cent cyanide, which is **perhaps** sufficiently strong."
7. "The mine is **about** two miles from the town."
8. "On the whole it is **perhaps** the largest property in the district."
9. "It is **rather** rare to see such a rich vein."

These examples will suffice; it is indeed an orgy of moderation. In every case the qualifying adverb is a mere frill, and can be dropped without loss of meaning. It reminds one of the custom that once obtained, among the managers for English mining companies, of initialing a statement of accounts and of adding "**E. & O. E.**," which stood for "Errors and Omissions Excepted." So every statement is subject to error, for is it not human to err? The qualifying adverb does not shift the responsibility, it only burdens the sentence. For instance, in No. 4, a man says the lode is "about ten feet wide"; we know well enough that the width of a lode varies from

point to point, and that it may be  $9\frac{1}{2}$  ft. in one place and  $11\frac{1}{4}$  ft. in another, so that the general statement that "it is 10 ft." expresses the fact; if you are speaking of a particular measurement at a specific spot it is better to say 10 ft. 3 in. or 9 ft. 9 in., than to qualify it with an **about**. It is an unscientific mode of expression; you know the width is ten feet or you don't; if you do know it, say so; if you don't, say what you do know. In the same way, in regard to the distance of the mine from the town (quoted in No. 7), to say that it is "about two miles" will not absolve you from error if it proves to be three miles, and as an attempt at accuracy it is but a pseudomorph, because the distance will depend upon which road you take. Moreover, in practical life, the exact distance is less important than the condition of the road; a four-mile haul over a good road will be less expensive than a two-mile haul over a bad one. Be accurate; don't merely affect it. A man who says "the lode is about ten feet wide" and "the vein is rather hard" and "the ore is probably free-milling," is likely to state that it contains "about two ounces" of gold per ton when on an average it carries only 15 dwt., and would probably estimate his ore reserves 50% too high.

**The Unnecessary Plural.**—A bad habit, which is becoming steadily worse, is the squandering of the plural. Writers speak of "the ores" of a mine and "the rocks" in which the lode occurs, when they have no idea of a variety or a number of either the one or the other. **Slimes, concentrates, fines, tailings, and sands** are all terms that are used by some people only in their plural form. It is a Mormonism of style. And apart from its

incorrectness, it causes the loss of a useful inflection. If a mill produces more than one kind of 'concentrate' or a mine several varieties of 'ore,' it is possible to suggest the fact by the employment of the plural. Moreover, the excessive sibilant is unpleasant in compounding, as in 'slimes-plant,' 'sands-vat,' 'tailings-sump.'

A **concentrate** is the product of a process of concentration; if several such products are formed (as happens occasionally), they are correctly known as **concentrates**.

A **tailing** is the refuse from a metallurgical process; if the refuse from several processes or more than one mill should meet, the result could be described as **tailings**.

Many writers appear to be unaware that **concentrate** and **tailing** are dictionary words, for they use only the plural forms.

Thus: "The gravels rest upon the older schists of the region." But it was of a particular deposit of gravel that the writer of this sentence was telling, and the "older schists" stood for *one* particular formation of schist. The two unnecessary plurals only befog the meaning, which is that "the gravel rests upon the older schist of the region."

The stuff that goes through a screen can be divided into 'coarse' and 'fine'; there is no need to pluralize the second into 'fines,' any more than there is to put the first in the uncomfortable position of 'coarses.'

Occasionally the loss of the plural will seriously hamper the expression of an idea, thus: "An experiment was made on two **sands** having the following analysis. (Then came the analysis.) Which of these two **sands** is the finest?" Incidentally, "finest" should be 'finer.' Or

again, "As at El Oro, one can calculate exactly the extraction from a **sand** when the sizing test has been made." Now try to express the distinctions made in these sentences by the use of the plural only. Surely it is unscholarly, and therefore unscientific also, to throw away a grammatical inflection of so elementary a nature. It will be found that loose writers, that is, those who do not think clearly and therefore are willing to write muddily, will scatter their plurals in every direction; in this there is a profuseness that is in keeping with the exaggerations of irresponsible journalism. It is another example of the choice of the abstract for the concrete, a blunder that marks the careless writer.

**Per cent** should be used only as a term of precision and when accompanied by an exact statement of quantity. Thus: "In treating this gravel an abundance of water is necessary, otherwise a great **per cent** of the gold will be lost." Here it is used in a vague manner, and the word **part** or **portion** would be more appropriate.

"But this class forms only a small **percentage** of the young men of this community." No percentage is given, the statement is vague, and the word **proportion** should be substituted for **percentage**.

**Excepting** is often used in place of **except**, as: "Your definition is correct, **excepting** that you do not go far enough."

Similarly, **partially** is used where **partly** is required. "The vat was **partially** filled." **Partially** means with partiality, and it should never be used without considering the claims of **partly**. These errors, like the use of 'experimentalize' in place of 'experiment', of 'preventative'

for 'preventive', are evidence of an effort to be impressive by using long words.

"**Consistency** is a jewel," but **consistence** is a quality belonging to molasses in a jug or to the slime in a cyanide vat.

'**Suppositious**' is a common error for **supposititious**.

**Approximate** and **approximately** are used too often as an elegant variation on **about**, as "He is approximately 90 years old."

**Series** is employed instead of **number**, even when there is no succession or connection between the events or objects mentioned, as "A series of scattered orebodies in the limestone."

There is a tendency to use **it** too much. Whenever at a loss for either a nominative or an objective, the scribbler throws an **it** into his sentence. Thus: "By the arrangement shown the centre of gravity will be low, and **it** leaves a compartment at one end." The "centre of gravity" leaves no compartment, the "arrangement" does so. We might say: "By the arrangement shown the centre of gravity is placed low, and a compartment is left at one end."

A similar criticism may be made in regard to the excessive employment of **them** and **their**. Thus: "Iron poles are to be avoided on account of the danger to line-men and **their** short life due to rusting." The line-men are not short-lived; and, though eventually they die, they do not rust; it is the iron of the poles that oxidizes.

"The slime from the mill is treated in a second plant and its contents are cyanided at a small expense." From

this the reader might infer that the contents of the secondary plant were subjected to cyanidation.

Referring to limestone rocks, a writer says: "In the residual clays left by their dissolution the farmers frequently make low wages by gophering after the liberated lead." The farmers did not undergo dissolution, otherwise they would not have been able to go for the lead.

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## CONCERNING TITLES

The title **Mr.** means nothing. There was a time when **master** or **mister** was a specific title of honor. It is so no longer. Similarly, **squire** denoted a shield-man or attendant on a knight. In England it is the custom to address a letter to your grocer as Mr. Henry Smith, but to address a letter to your friend as Henry Smith Esq. In America **Esq.** is used by a few people at Boston, but elsewhere it is rare. **Squire** and **Esq.** are verbal derelicts of the feudal system and they possess historic interest, but they have nearly passed out of use. In America it is as correct to write to Mr. Roosevelt (in his private capacity\*) as plain Mr. Theodore Roosevelt, as it is to write Mr. Henry Smith when you send your grocer his check in payment of the month's account. In England they still distinguish between amateurs and professionals by prefixing **Mr.** to the first and omitting it before the names of the second, so that you read of a cricket match in which Mr. Henry O'Brien is bowled by Jones. The latter did not lose his pronomen nor his title of Mr. because he was a bowler but because he was a professional, the batsman (Mr. O'Brien) being an amateur. In cricket the adoption of this style has its convenience but, nevertheless, it is a humorous survival of a class distinction. In America the class distinction is gone, and so is that between the amateur and the professional; here amateurs are scarce, for we make

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\*In writing to the President officially, it is correct to address the envelope "To the President. The White House. Washington, D. C." and to begin the communication thus: "The President: Sir—"

a business out of sport; also we have no class distinctions, only differences of bank balances.

Therefore **Mr.** is meaningless and in technical writing it can be largely omitted. As a matter of taste it is preferable, and as a matter of accuracy it is better, to use the initials or the first name. Thus: "The engineer in charge of construction is C. E. Palmer" is better than writing that he was Mr. Palmer. At the second reference, it is usual to omit the initials and to say Mr. Palmer, as in ordinary conversation.

Never prefix **Mr.** or any other title to the names of the dead; that is the worst snobbery of all. Thus: "In the death of Kelvin, England lost a great investigator." "By the death of Charles A. Molson, the mining profession lost one of its leading members." To put **Lord** before the immortal dead is bathos and to place **Mr.** before the name of a vanished personality is like bowing to a mummy.

Then we come to the use of such titles as **Professor** and **Doctor**, with their abbreviations **Prof.** and **Dr.** In England only a physician is addressed as Doctor. Surgeons, veterinaries, and dentists are denied the privilege. So far so funny, but the custom mentioned has not prevented doctors of divinity and doctors of science from taking to themselves the title usually associated with the healing art. In America, it is chaos; the titles Professor and Doctor are employed so loosely that they are well-nigh meaningless. We may well follow the example of Samuel Johnson, who, although in receipt of a doctorate of laws from Oxford University, never signed himself or referred to himself as Dr. Johnson, he was Mr. Johnson when he was not plain Sam Johnson. For my part I cannot see why a

Master of Arts should not be addressed as Master if a Doctor of Philosophy is entitled to be called Doctor. Moreover, in the West, an Attorney General is usually called General and a Surveyor General is easily mistaken for a military chieftain of the highest rank. They are as much 'generals' as the general dealer in merchandise or the man who has general supervision of street construction. In Kentucky every gentleman is a colonel, at Washington every scientist is a doctor; in fact, my friends of the United States Geological Survey will, I trust, not be offended if I say that it is apparent, from official sources of news, that the chiefs are Doctors, the seconds in command are Professors, and the chain-bearers are plain Misters. One of the worst sinners in this regard is *Science*, the organ of the American Association for the Advancement of Science. The editor of that weekly magazine bestows his accolade with rare impartiality and gives degrees with unrestrained generosity. Lately, the list of contents gave the names of a Professor who was not—and never had been—a professor; of a Doctor, who was an M.A. and not a Ph.D.; of a Mister who had a Ph.D. from Columbia. The gradation of title merely expressed the editor's sense of the degree of courtesy it was proper to pay the several writers. Of course, such misuse of title is grotesque. We love to call some of the veterans 'Doctor,' for they got their Ph.D. at a time and at a place where the honor meant something; nowadays every little college grants doctorates, so that they have no significance unless the name of the grantor university is affixed. I remember a friend of mine in Colorado who was given an honorary Ph.D. by the State University because he was the promoter of a

paper-mill and other useful local enterprises, and my friend valued the honor chiefly because it made him eligible for the University Club at Denver. Furthermore, a doctorate does not indicate even the same degree, for Dr. Edward D. Peters and Dr. F. L. Bosqui are graduated physicians, although both have become authorities in metallurgy; they are not doctors of philosophy, as might be inferred. As to professor, that title belongs first to the peripatetic corn-doctor and next to the instructor in dancing. At Harvard the professors are addressed as **Mr.**, and the unnecessary use of **Professor** is deemed provincial; although, in speaking of lecturers, the term 'professor' is employed, in order to distinguish them from 'instructors'.

In a democracy rank does not exist outside the army and the navy, and among civilians good taste dictates the minimum use of titles. The true American has no superior, *and* no inferior. In Europe titles express positions, class distinctions, and social courtesies, and they form a part of the old-world customs; they have historic warrant. In America, they are solecisms.

The following are examples of correct usage:

"Mr. James F. Kemp, professor of geology in Columbia University."

"He graduated from Cornell University."

"In deference to the wishes of Mr. S. B. Christy, the dean of the mining department of the University of California."

When you refer to persons bearing foreign titles, be careful to be correct, for to a foreigner they mean much and to be careless is either to be discourteous or to confess your ignorance.

## MATTERS OF USAGE

The **split infinitive** is not always avoidable; occasionally it serves to convey a special meaning. Avoid it, however, if you can.

The omission of the definite article (**the**) before foreign names commencing with the definite article (**Le**, **La**, **Il**) recommends itself on the score of repetition, but it is likely to cause confusion. The French or Spanish article joined to another word is as much a part of the name as the noun itself, thus: "We have something interesting to show you in the Mexico mine and also in the El Oro" is clear, but the omission of the article before El Oro would suggest that there was "something interesting" in the district of El Oro, in which **the** El Oro mine is situated. Even in Spanish, one would say "*el distrito de El Oro*" or "*la mina El Oro*," not "*la mina Oro*" or "*el distrito de Oro*." So also we speak of "the La Rose mine" at Cobalt and "the Le Roi mine" at Rossland, and even "the Las Dos Estrellas mine" at El Oro.

**Preposition Verbs.**—The use of prepositions with verbs, and the consequent ending of a sentence with an insignificant word, is a defect peculiarly British, although not unknown on this side of the Atlantic. For example:

1. "The finest mine I **met with** in my travels."
2. "No large body of payable ore has been **met with**."
3. "At that time it was intended to sink a shaft along the drive at a place where the new make of stone had **come in**."
4. "The shares are being **dealt in** at a large premium."

5. "A road has been **reported on** as practicable."
6. "All but 200 tons was **operated on** in Pahang."
7. "The slime separated **makes up** a capacity of 500 tons per day."
8. "This is true in **dividing up** geological time."
9. "The influence of the old views has so **clung on** that the tendency has been to **give up** the idea of time."
10. "The vein has been **cut**, and new men will be **put on** to drift on it."
11. "The vein is **split up** into stringers."
12. "The disturbance **tilted up** the strata."
13. "End bearers 12 by 12 in. **let in** 16 in. into each wall."
14. "The ore is **fed in** at the curved end."
15. "The weak solution is **turned on** at first."

It will be noted that usually the preposition forming part of the verb is followed immediately by another preposition; this is ugly. Moreover, while in speaking, the verb and its preposition may be held together so as to effect a separation from the following preposition, in writing this is not indicated. We do not write: "The finest mine I met-with in my travels," but we space the words equally, so that it might be read: "The finest mine I met with-in my travels." In German such verbs are frankly compounded, and if they are to be used in English it might be well to hyphenate them, but it would be better still to avoid the use of them altogether.

It was "the finest mine he saw" that he meant; he did not meet the **mine**, nor did the mine come forth to meet **him**. Similarly, in the second example 'intersected' or 'found' would serve.

The third quotation is obviously Australian, for 'make of stone' betrays its origin, even if 'drive' (meaning 'drift') did not do so. In this case the new orebody had been 'cut' or 'exposed'.

The fourth is often to be read in financial papers; it can be circumvented by saying: "There were dealings in the shares at a large premium."

So also the fifth and sixth are common; we read that a mine has been **reported on**, etc. Why not say: "A report on the mine has been made."

In the seventh **makes up** should be 'constitutes' or 'forms'.

In the eighth, the preposition can be dropped, while in the next quotation both prepositions have some value and it is rash to suggest an improvement. We might say that "The influence of the old views has clung to geology so that the tendency is to abandon the idea of time."

In the tenth, eleventh, and twelfth the prepositions are redundant. In the thirteenth the confusion between the preposition **in** and the abbreviated form of 'inches', is awkward. 'Projecting' into the wall or 'inserted' into it might express the meaning.

As to the fourteenth, evidently the ore is not fed **out**; the **in** is not needed. This is like **upraise**, which is found in some mine reports, as though anyone raised *downward*. In the fifteenth example **turned on** must be left as it is, with the ugly second preposition following it, or another phrase must be used. **Turn on** and **turn off**, as meaning to start or stop the flow (as in this case, of a solution), are required in technical writing because we have no equivalent that will do duty for them. It is not intended

to state that all these preposition-verbs can be dispensed **with**, but it is suggested that certain ungainly sentences can be modified to advantage by avoiding the use of them.

“The visiting engineer should be **put up** by the owner of the mine on the property.” An Anglicism; a man is ‘put up’ when he is entertained, and if the hospitality is inadequate he must **put up** with it as best he can.

“Upon the melting **down** of the charge.” How does this differ from the melting **up**? Many metallurgists prefer the latter, although the first suggests the subsidence that follows liquefaction of fragments. Neither preposition is necessary.

A mill is started **up** and then is closed **down**. In these cases the preposition gives added force and is excusable, though unnecessary and ugly. On the Rand the white men ‘boss **up**’ the coolies. We learn that “with the large machines almost half of the time was taken **up** in putting **up** and taking **down**.” It reads like an obstacle race.

“The velocity of the escaping gases is too great to permit of the settling **out** of the finest particles.” If the particles settle, they settle; that is enough. Of course, there are people who settle **down** in the country because they cannot settle **up** their debts in the city, but that is neither here nor there.

It is worth remarking that so clever a book as ‘The King’s English,’ which offers an effective criticism of representative English writers, is guilty of the following sentences: “It is insulting to the reader, implying that he was not worth working **out** the sentence **for** before it was put **down**.” After such a performance we venture

to express opposition to the authors' approval of the termination of a sentence with an unimportant word, as will happen often when preposition-verbs are employed.

A Western miner, who has overslept, will say that he has 'slept in,' and after he has been to the boarding-house he will state that he is 'full up.' A little later he will 'hide out' from the foreman by 'climbing up' into an 'upraise.' Why should we perpetuate the blunders of the illiterate? The miner has much to teach us, especially how to find ore and how best to extract it, but the selection of terms or the use of language is not his province, and he does not thank us for putting him in a false position.

In speaking or writing concerning technical matters, it will be found that there is an insistent multitude of preposition-verbs. If note is taken of their clumsiness and of the awkward sentences produced by the use of them, it is likely that they will be avoided. It is easy to do so. Try a re-arrangement of the sentence or a substitution of terms. It is good practice.

Most preposition-verbs can be replaced advantageously by plain verbs; for example:

aim at	=	attain	fall off	=	decline
arrive at	=	reach	go on	=	advance
call for	=	demand	keep up	=	maintain
carry out	=	perform	look after	=	watch
come in	=	enter	make up	=	compose
deal with	=	treat	prove up	=	test
do away with	=	discard	put in	=	insert
end up	=	conclude	work out	=	devise

Some of the prepositions attached to compound verbs

are used adverbially, for they modify the verb, but this does not affect the argument.

**Tautology.**—"The shaft is being sunk deeper." A shaft must be sunk **deeper**, if it is sunk at all.

"The men on that shift drove the drift forward four feet." They would not be likely to drive it **backward** or even laterally, for then it would become a **cross-cut**.

"It is radically wrong **in its inception** from the start." Words, mere words. Those indicated are not needed.

**Payable** means due as to payment or capable of being discharged by payment. It is used in mining as a synonym for **profitable**. The ore does not **pay**, nor is it able to pay what is unpaid and due; the use of the word is to be condemned, for it was introduced by illiterate persons and is a blunder. We do not need **payable**; use **profitable**. **Pay-ore** is now a recognized technical term and is out of the reach of a protest.

It is better to say 20 ft. **wide** than 20 ft. **in width**. Similarly, 10 ft. **long** is preferable to 10 ft. **in length**. Except when *not* preceded by a number, as: "The orebody has increased in length as the mine has been deepened." Or: "This vat differs in breadth from the other."

**The latter** is employed in a confusing way; sometimes it is used where **last** is required. Thus: "I am using 18% coke on the charge and I may get to 17 or even 16%. The latter figure I hope to reach." Here there are three percentages; he means the **last** of them.

"The gangue minerals consist of calcite, quartz, dolomite, gypsum, and calamine, native silver occurring in vugs of the latter." **Occur** is overdone by many writers. "Latter" should be **last**. As gangue consists of minerals, necessarily, the use of "minerals" is undesirable.

**The Indefinite Pronoun.**—As a rule, educated Englishmen use their own language skillfully, because they receive instruction in grammar while at school, and they are not in a hurry. Nevertheless, they have two peculiar faults. One of these is the use of preposition-verbs, as already mentioned; the other is the frequent employment of the indefinite pronoun **one**, as in:

“**One** would not be inclined to believe the statement.”

In some instances it becomes almost an obsession, as in the case of a man with whom I discussed the future of the Royal School of Mines. He said something like this: “Looking at the subject broadly, **one** would suppose that the Government would give better support to the plan, for **one** can see no reason why they should not do so; and certainly **one** has a right to expect something in behalf of so important an institution; but in matters like these **one** almost despairs of **one’s** countrymen.” It is a sort of mock-modesty, an exaggerated effort to avoid egotism and self-assertion. It may be that those of us who live in America are a bit too assertive, but at least we know our own minds and are willing to accept the responsibility for the statements we make, instead of fathering them upon a shadowy something that masquerades in the garb of a shamefaced pronoun. Examples of this peculiarly British habit are easy to obtain; here is one from a book (and a good book too) by H. G. Wells; speaking of the dispersal of population by reason of improved locomotion, he says:

“The towns **one** inferred, therefore, would get slacker, more diffused, the country-side more urban. From that, from the spatial widening of personal interests that ensued,

one could infer certain changes in the spirits of local politics, so one went on to a number of fairly valid adumbrations. Then again starting from the practical supersession of all unskilled labor by machinery one can work out with a pretty fair certainty many coming social developments, and the broad trend of one group of influences at least." And so he proceeds. Now, it happens that he is referring to his own opinions as expressed in a book previously published, and it is no unknown person or public opinion or a debating society, but H. G. Wells, that is supposing and suggesting these interesting ideas. Put the first pronoun singular, the aggressive **I**, in the place of one and the whole statement gains vigor and an additional meaning, for these are *his* ideas, the ideas of a particular social philosopher, and not of a chimera ruminating in a vacuum.

In the quotation from Wells, it will be noted that the numeral one occurs in the same sentence as the pronoun one; this is awkward. So also is the uncertainty as to whether one should be followed by a singular or plural pronoun. For instance:

"People here know that this kind of speculation gives one a run for **their** money." **Their** should be **one's**, but even that is awkward. Get rid of the one.

Of course, egotism is to be deprecated and the iteration of the first person singular is tiresome, but in technical writing, where definite statements are made by a specific observer and personal investigations are recorded by individuals, it is a mere pretence of modesty to use these elegant variations. It detracts from the vividness of a statement without lessening the responsibility for it, and often results in awkward circumlocution.

## RELATIVE PRONOUNS

Most writers employ **that** as an agreeable variation from the too frequent use of **who** and **which**; they regard **that** as interchangeable with the two other relative pronouns and make euphony the sole arbiter of their choice. However, among the helps to clear expression I include the proper use of these three relative pronouns. The neglect to distinguish between the functions peculiar to them severally is an error common to technical, as to ordinary, literature.

A relative clause is introduced by a relative pronoun; it has a subject and predicate of its own, and refers to, describes, or limits a previous word. The word or group of words to which a relative pronoun refers is called its 'antecedent'; as in the sentence "He in whom we trust," where "He" is the antecedent described by the clause "in whom we trust."

The relative pronouns serve as reference-words and connectives. **Who**, with its possessive **whose** and its objective **whom**, is both singular and plural. It refers to living things, usually persons, sometimes animals. By poetic license inanimate objects may be personified, so that we may speak of "the city whose future is assured." But it is not well to say: "The stamp whose descent on the die crushes the ore." It will be more correct to substitute **of which** and say "The stamp, the descent of which on the die, etc." This is correct; but it is awkward, which is a hint to reconstruct the sentence and omit the relative pronoun, thus: "The stamp, by descending on the die,

crushes the ore upon it," or "The stamp falls on the die so as to crush the ore."

**What** always refers to things, never to persons. The antecedent to **what** is not expressed. Thus: "What will happen, no man can foretell."

**Which** is not inflected. It refers, with rare exceptions, to things only. **That** also is not inflected, it refers either to persons or things.

The main problem is the distinction between **that** on the one hand and **who** or **which** on the other. Grammarians and writers differ as regards the restrictive function of these relative pronouns. Thus: "The friends that I loved are dead" seems better than "The friends whom I loved," for it is the beloved friends as distinguished from ordinary friends that are dead. You say "The father whom I loved is dead," rather than "The father that I loved," because a man has only one father and the use of the term is sufficiently restrictive.

A useful rule for the use of **that** and **which** is given by Professor Bain and quoted by Edwin A. Abbott in his invaluable guidebook called 'How to Write Clearly'. It is: "When using the relative pronoun, use **who** and **which** where the meaning is 'and he', 'and it', etc., 'for he', 'for it', etc. In other cases use **that**, if euphony allows."

Thus: "I heard this from the mine manager, who (and he) heard it from the man that was in charge of the work."

Abbott also says: "**Who** and **which** introduce a new fact about the antecedent, whereas **that** introduces something without which the antecedent is incomplete or undefined. Thus, in the above example, "mine manager" is complete in itself, and **who** introduces a new fact about

him; "man" is incomplete, and requires "that was in charge of the work" to complete the meaning.

Let us go into the matter a little deeper; but before venturing upon controversial ground, I shall state one safe guide to lucid diction, namely, whenever a sentence appears doubtful in the light of a rule, it is likely that the sentence (not the rule) needs changing.

#### **When in doubt, rebuild your sentence.**

Relative clauses are divisible into 'defining' and 'non-defining'; the function of the first is to limit the antecedent, this limitation being effected in several ways. In whichever way the defining clause does its work, it is essential to, and inseparable from, the antecedent. By this test it can be distinguished. Thus: "The process which will extract both the metals is likely to be adopted." In this case "will extract both the metals" is the relative clause introduced by **which**. The antecedent is "the process." The clause limits the kind of process referred to, by stating that it "will extract both the metals"; therefore, it is a defining clause and should be preceded by **that**. The sentence is better thus: "The process that will extract both the metals is likely to be adopted."

"The process, which is of recent invention, extracts both the gold and silver at a cost of 50 cents per ton of ore." Here the relative clause ("which is of recent invention"), introduced by the pronoun **which**, is non-defining; it merely gives a bit of incidental information, leaving it to the principal clause to predicate concerning the antecedent ("the process") that it "extracts both the gold and silver at a cost of 50 cents per ton of ore."

Exceptions will occur. There is an exception to every rule except the one that a man must be present when he is

shaved. **That** does not permit direct modification by a preposition. We cannot say "The man in that we trusted," although colloquially we may say "The man that we trusted in"—an awkward clause, ending with a preposition. To 'trust' a man and to 'put your trust in' a man express two shades of meaning, of which the second is much the stronger. Finally, to serve the purpose, we say "The man in whom we trusted." Moreover, **that** is not available for all restrictive clauses, for it may make confusion with the conjunction **that**. Thus: "It was clear that that man could be of no service to me" or "We noted that the people that composed the mob were beside themselves." In both examples an unpleasant collision between the conjunction and the pronoun can readily be avoided by reconstructing the sentences. In the first, the two **thats**, if spoken, are differently accentuated, but the distinction is lost in the written words.

**That** when used of persons, has come to look archaic and **who** is preferable, except when the antecedent has attached to it a superlative. We say:

"He is a man who dreams all day."

But we may say:

"The most impartial man that I know."

Let us proceed. The removal of the defining clause destroys the meaning of the antecedent. This is a sure test for distinguishing the defining from the non-defining clause. Thus, in the sentence: "The process that will extract both the metals, is likely to be adopted," if the clause "that will extract both the metals" be omitted, the sentence becomes meaningless, for to say that "the process is likely to be adopted" without indicating in any way the particular process, would be senseless. In the other ex-

ample: "The process, which is of recent invention, extracts both the gold and silver in the ore at a cost of 50 cents per ton," the non-defining clause "which is of recent invention" can be detached without interfering with the significance of the principal statement that "the process extracts both the gold and silver, etc." Countless processes are "of recent invention" but only special processes will "extract gold and silver at a cost of 50 cents per ton of ore."

Furthermore, a non-defining clause gives independent comment, description, or explanation—anything but limitation of the antecedent. In the last example, the relative clause can be written either as a parenthesis, or as a separate sentence, thus: "The process (which is of recent invention) extracts, etc," or "The process is of recent invention and is said to extract both the gold and silver, etc." This cannot be done with the defining clause in the preceding example without decapitating the sentence, for "the process (which will extract both the metals) is likely to be adopted" or "the process is likely to be adopted and it will extract both the metals" are both badly expressed.

To ascertain whether a clause does (or does not) define, remove it, and it will at once become apparent whether it is essential; if it is essential, it defines. Ambiguous cases are frequent, because some clauses are capable of performing either function and an undiscriminating writer may fail to make himself understood. The uncertainty, as to whether the clause is limiting or descriptive, can be obviated by making plain what is the antecedent. **Re-write the sentence, so that the meaning becomes clear beyond peradventure.**

Punctuation should be a guide in most doubtful cases,

for the non-defining clause ought to be preceded by a comma. But this test is not reliable, simply because punctuation is often slighted. This much may be said: The information given by a defining clause must be taken at once, with the antecedent, or both are useless; while the information given by a non-defining clause will keep, the clause being complete in sense without the antecedent.

A few examples will serve to illustrate. The first three are taken from one of my own books, written before I paid attention to the nicety of these distinctions.

“A good millman has the clarified common sense which lies at the basis of true science.” Here the last clause defines, the reference is to a special kind of common sense, namely, *the* kind that “lies at the basis of true science.” However, in this case no misunderstanding is caused by the use of **which**, the clause carries the meaning of limitation in either case, and no harm has been done. Yet, the sentence is clearer and stronger with a **that**: “A good millman has the clarified common sense that lies at the basis of true science.”

“That interval of time is utilized in the shifting of the material which the hammer blows are shaping.” Here **which** is evidently an elegant variation from **that**, which has been used just before. The antecedent “material” is defined by the relative clause, which describes it as the particular material undergoing shaping by the action of the hammer. Therefore **that** is required in place of **which**. But, even more certainly, the sentence requires change. The **that** before “interval” might well be changed to **this**, for the reference is to an “interval of time” previously discussed. As soon as **this** is used the

hankering for euphony is satisfied and the **that** before "the hammer" becomes comfortable.

"The hammer which cracks open the nut may liberate the kernel without crushing it." This also may be amended, for the antecedent "hammer" is limited by the clause as one that "cracks open the nut." Therefore **that** is better. Here also no particular harm is done, for the meaning is not upset, as it is in the additional examples, which are taken from other authors.

"The Trail smelter is treating ore from the Sunshine mine at a profit which only runs 1.4% in copper, \$1.50 in gold, and 23 cents in silver." This says that the "profit" runs so much, but it is the "ore" that contains the metals mentioned. The clause introduced by the relative pronoun in this instance is defining and the information given must be taken with the antecedent, which is "ore," not "profit." "At a profit" is incidental and only needed for emphasis, since ore is not "treated" usually except "at a profit." Re-arrange the sentence, thus: "The Trail smelter is treating, at a profit, ore from the Sunshine mine that runs only, etc." Or "The Sunshine mine is supplying ore to the Trail smelter and this ore yields a profit, although containing only, etc."

"There is a singular absence of oxidation in these ore-bodies which may be due to the protection afforded by the 'drift' which has in the Glacial period mantled the whole district." Is the "oxidation" or are the "orebodies" due to the protection of the 'drift'? It is a mark of the non-defining clause that the information it conveys may be postponed; it need not follow immediately on the heels of the antecedent. In this case **which** introduces the clause referring to the "oxidation"; therefore it is correct,

though the sentence is ambiguous. But in the latter part of the same sentence there comes another relative clause describing the 'drift' and limiting it by stating that it is "the Glacial drift" responsible for the alluvium "mantling the whole district." There might be other kinds of 'drift', formed in other geological periods and distributed over parts of the district, but this is not one of them; the clause defines, and the relative pronoun should be **that**. The mere doubt as to the meaning indicates that the sentence needs to be re-arranged, as thus:

"In these orebodies there is a singular absence of oxidation, which may be due to the protection afforded by the 'drift' that mantled the whole district during the Glacial period."

"The law has many defects and contains a number of clauses which should be changed as soon as possible." There are certain "clauses" requiring change, those that are "defective" should be changed; the clause is definitive and not incidental. **That** is preferable to **which**.

"The elevation which occurred in Pleistocene time and which affected the American river, may have had some influence on the Yuba." The question is as to whether the writer refers to a particular elevation occurring in the Pleistocene period as distinguished from others that happened earlier or later. Or does he refer to a solitary elevation during Pleistocene time? The context shows that he is speaking of one out of many elevations and that he indicates a particular one occurring at a particular period and causing specific geological changes, therefore the sentence ought to read: "The elevation that occurred in Pleistocene time, etc., may have had some influence on the Yuba." The second **which** (preceding "affected") is jus-

tified by the first (after "elevation"), and the doubtful use of one suggests the advisability of eliminating the second by a reconstruction of the sentence. **When in doubt, re-write your sentence. A doubtful meaning is much worse than doubtful grammar.** The sentence may be changed thus: "The elevation that affected the American river during Pleistocene time may have had some effect upon the Yuba also."

"There is a mine in the downtown district which is in a position to furnish large quantities of manganese ore." The 'downtown' is a part of the Leadville district within, and adjacent to, the city itself. The question arises: Is the "mine" or the "district" to furnish the ore? The sentence says the latter; other information points to the former. The two can be harmonized by employing **that**. Avoid ambiguity and rebuild the sentence, thus: "In the downtown district there is a mine that is in a position to furnish large quantities of manganese ore." The antecedent ("mine") calls for definition and marks the clause following **that** as belonging to the limiting kind. As rearranged the meaning of the sentence is unmistakable and even the use of **which**, though erroneous, would not obscure the statement of fact.

"The manager cut a vein in the Brooklyn ground which was developed at the 800-ft. level." If the reference is to the "ground," then **which** is correct, but it should be preceded by a comma. If the "vein" is referred to, then **that** is required because the clause defines the particular vein "in the Brooklyn ground" and "developed at the 800-ft. level." The context proved that the latter was meant. The doubt indicates that the sentence requires change. It might be re-written thus: "The manager explored the

Brooklyn ground and cut the vein that had been developed at the 800-ft. level." Which 800-ft. level? It was the 800-ft. level of the mine adjoining the Brooklyn. Let us call it the New York. Then we get at the true meaning of this cryptic sentence, thus: "The manager did some work in the Brooklyn ground and thereupon cut the vein that had been previously explored at the 800-ft. level of the New York mine, which adjoins."

Occasionally even when **which** is correct, it is advisable to substitute the equivalent **and it**, thus: "According to my tests 58% of the assay-value of the ore could be saved by a series of concentrations which, owing to the careful adjustments necessary, is not always obtainable in every day working of the mill." This can be improved, for the second sentence tumbles all over the first so as to confuse the idea to be conveyed, like two horses in tandem that want to turn round and shake hands with the driver. After the word "concentrations" put a dash (to express the break in the sequence of thought) thus: "—and this, owing to the careful adjustments necessary, is not always practicable." A further improvement can be made by substituting **but** for the **and**. **Practicable** gives the exact intent of the eight words for which it is substituted.

It is interesting to note that this distinction between the uses of the relative pronouns is observed in Elizabethan writers, notably Shakespeare himself. Many modern authors disregard it. To technical writers it will be found a convenience in attaining lucidity of expression.

For the sake of euphony, when the conjunction **that** has just been employed or when the antecedent is qualified by **that**, it may be necessary to avoid a disagreeable repetition of the word. Then use the participle, as "Men work-

ing underground" in place of "Men that work underground." Or use the infinitive, as "He was the first manager that succeeded in making the mine profitable" may be changed to "He was the first manager to succeed in making, etc." Similarly, if **which** is overworked, substitute **and this**; thus: "He worked hard, which was all that he could do," can be written "He worked hard, and this was all, etc." Then, if despite these variants, the sentence is still overburdened with relative pronouns, there is one remedy: **Re-write and re-arrange. The English language is not at fault, but you are.**

I am aware that no part of the present writing is so open to criticism as this attempt to elucidate the use of the relative pronouns. It is likely that in my effort to emphasize the neglect of one of them, I shall be charged with undue partiality for **that** and a prejudice against **which**. The attempt to state useful rules may read like an effort to establish irrefragable laws. Our language, so the critic will say, has other devices to mark the restrictive clause and it is easy to avoid the monotony of an arbitrary rule. For instance, the definite article **the** attached to a noun not previously made definite in the context, distinctly points forward to the relative clause, or whatever may take its place, as a limiting expression. Professor Whiteney says: "Some authorities hold that **who** and **which** are to be used as co-ordinating or simply descriptive relatives, but **that** as limiting a descriptive. . . . But the best English usage by no means requires such a distinction."\* Again it may be asserted that "the relative clause is not necessarily of one sort or the other, it is fre-

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\*'Essentials of English Grammar.' Page 77.

quently both, or hovers delicately on the margin between the two." So says Professor Bradley of the University of California. He also argues against any attempt "to force speech into a cast-iron mould in defiance of its chartered freedom of ages. Every predication about a thing, no matter what its form, logically limits it, defines it, narrows the concept."

So it is well to go gently. As a matter of fact there is no arbiter in such matters, save the reader. Put yourself in his place. Use such words as will best enable the transfer of thought with least worry to the recipient. In some cases you may avoid ambiguity by using **that** instead of **which**, in other cases **that** is no better than **which** and only serves as a stumbling-block to the transfer of ideas. So I apologize if my statements have seemed too arbitrary; my purpose is simply to stimulate the attention of technical writers to some details of their literary mechanism.

This discussion concerning relative pronouns is worth while, if for no other purpose than the light it throws on the necessity for re-constructing doubtful sentences. Grammar is worthy of respect, euphony is desirable, idiom is not to be neglected; but precedence must be given to clearness of statement. Sacrifice everything to this attainment and you will find that you have included most of the other qualities. It is seldom necessary to forego any of them, for the resources of our language are equal to all the demands of exact and felicitous expression. Be lucid, and all these other qualities shall be yours, as you desire them and practise to attain them.

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## EXAMPLES OF JOURNALESE

1. "The strike in the Ophir mine has been demonstrated to be of a **permanent** character." This refers to the finding of ore; the writer means that the lode has been proved to be **persistent**.
2. "This is no secondary enrichment, it is a **permanent** orebody." Here also **permanent** is used instead of **persistent** or **continuous**.
3. "The principal work being **prosecuted** at this time is in the shaft."
4. "The Butte & Arizona Co. is **prosecuting** development work with **vigor**."
5. "A vigorous campaign of development is being **prosecuted**."

Certainly, the writers of these sentences ought to be prosecuted. In the first example, the word 'done' would serve the purpose and in the second 'pushing' would suffice. The third quotation is an example of disproportionate language, for it happens to refer to unimportant mining operations, and it might have been stated that "steps have been taken to develop the mine rapidly" or "it has been arranged to sink the shaft without delay."

6. "It is announced that concentrating facilities will be provided for near the mouth of the tunnel," meaning thereby that a concentrator is to be built near the mouth of the adit.

7. "The Frisco Co. is unable to place its new equipment in commission." That is, the company is unable to start its new machinery (for lack of fuel).

8. "Vigorous cross-cutting is being **inaugurated**."

9. "The **inauguration** of an extensive plan of development."
10. "An extensive campaign of development has been **inaugurated**."
11. "Ore shipments have been **inaugurated**."
12. "Work on a 50-ton mill is to be **inaugurated** in September."
13. "**Extensive** improvements have been made."
14. "An **extensive** mine equipment has been provided."

Both **extensive** and **inaugurate** are good words in the wrong place. **Extensive** means extended widely; in No. 10 it is not misplaced, but in No. 9, 13, and 14 'elaborate' is meant. In No. 13 'big' would probably do, and in No. 14 'expensive' may be surmised. As to **inaugurate**, that word, like **prosecute**, is merely grandiose. The President is inaugurated, not a "plan of development." In No. 8 'started' is meant; in No. 9 **inauguration** should be 'commencement'; in No. 10, 11, and 12, 'begun' or 'commenced' will serve.

15. "A new tramway is being **installed**." It is being 'erected' or 'built'.

16. "A large **per cent** of the mining and milling **installations** are designed by machinery builders." **Per cent** is wrong; it should be used only as a term of precision with a number, here it means merely 'portion' or 'proportion', that is, "A large proportion of the mining and milling machinery was designed by manufacturers." **Installation** is a pretentious word. You **install** or **induct** a man into office.

17. "Since the **installation** of the air-compressor, operations have been **extensively prosecuted**." Thorough

journalese. **Installation** is out of scale, for a two-drill compressor has been erected to hasten the work or to increase the output of ore. **Installation, inaugurate, and prosecute** are words that are the stock-in-trade of the boosters of 'wild-cats'.

18. "As soon as the heading has been advanced far enough, **drifting** both east and west is to be **inaugurated**." Here **driving** is required. You **inaugurate** a new reign or a presidential term, but you do *not* inaugurate the driving of a level or the cooking of an egg.

19. "In some instances the adoption and encouragement of the contract system has proved most advantageous **and efficacious**." An example of tautology; the last two words serve no useful purpose.

20. "A mine in which the company recently acquired **extensive** interests." Here the objectionable word means simply 'large.' It might be **expensive**, but *not* extensive, for interests (that is, holdings) are not measured by their length, but their number or their value.

21. "The first **extensive** shipment came from the 425-ft. level." 'Important' or 'large' can be substituted.

22. "In the earlier working of the mines, tunnels of considerable length—approximating some twelve miles or more—were driven for the drainage of seepage." This should read "In the early working of the mines adits of great length—twelve miles or more—were driven to drain the seepage."

23. "Limestone of any character in the producing **sections** of the district seem equally **prolific**." This should be: "The different limestones in the productive areas of the district seem to be alike ore-bearing." **Prolific** is not justified. **Sections** is colloquial.

24. "As it was a *sine qua non* that this shaft should be sunk 100 ft. within three months." The subject does not warrant a Latin phrase, nor does the sense require it. The use of Greek or Latin, French or German, where English suffices, is a mark not of the literate, but of the pseudoliterate, man. The sentence can be improved by saying either that it was **necessary** or a **condition** of the contract that the shaft should be sunk as stated.

25. "It is a foregone conclusion that had it been possible to build a mill, a large amount of low-grade ore, carrying **more or less value**, would have **undergone a method** of treatment, rather than be thrown over the dump." Sloppy writing. If it had **no value**, it would not be ore; the **more or less** is only the pretense of accuracy. An ore does not undergo a method, it undergoes a treatment. The sentence may be amended thus: "It is certain that if it had been possible to build a mill, a large amount of low-grade ore would have been treated, instead of being thrown over the dump."

26. "The ores of the Bully Hill district contain much higher **values** in gold and silver." The writer means, and he ought to say, that: "The ores, etc., are richer in gold and silver."

27. "A six inch streak of ore is exposed that carries **values** from assay tests varying from 1000 to 1500 ozs. in silver to the ton." This is as full of errors as a water-melon is of pips. Hyphens are needed between **six** and **inch**, also between **assay** and **tests**. This streak of ore carries neither **values** nor algebraic formulae, but metals; in this case, silver. The plural of the abbreviation **oz.** is inexcusable. The sentence may be amended thus: "A six-

inch streak of ore is exposed, carrying from 1000 to 1500 oz. silver per ton, as determined by assay-tests."

**Some of the Worst.**—Here is one describing the operation of a machine-drill:

"Following the shooting, the **mucker** begins his work, the drill man climbs to the top of the **muck**, and by the time the four feet of ground shot down is **mucked out**, he is again ready to shoot his round of holes." **Muck**, **muck**, **muck**—it is the very muck of writing. The word means filth or manure. It became used as a synonym for **dirt**, the miner's term for broken rock. Thus **muck** refers to the shattered rock resulting from blasting; it is not in the least filthy. **Shovelers**, that is, those who shovel the broken rock into the car at the face of a level or cross-cut, are now called **muckers**. What gain is there here? **Shoveler** is significant, **mucker** is the rubbish of words.

The next example comes from a description of the small locomotives used in mines. It reads:

"Face gathering, wherein the locomotive must enter the room, imposes conditions which call for distinctly special treatment in the design and equipment of a locomotive of high efficiency. The ordinary haulage locomotive in nearly all cases is totally unfitted to this work, which involves operation in narrow quarters, around sharp curves, over poorly laid tracks, etc. The locomotive of real value in room work is one which, by reason of proportions and construction, will go wherever a mine car will run, and with equal facility. It must be compact, no wider than the wheels, with short wheel-base and small wheels, and without long overhang at either end."

This is the sort of thing that makes a technical description seem like a cryptogram or a slab of picture-writing

from Nineveh. To any one versed in the subject of locomotives for underground use, this paragraph is intelligible, but only that. It succeeds in making the subject as uninteresting as possible and the meaning as much beneath the surface as the locomotive itself.

Both of these examples come from 'write-ups', the trade name for a eulogistic description of a manufactured article, prepared in the interest of the manufacturer and written by a man more accustomed to the use of a screw-driver than a pen. The worst writing concerning technical matters is to be found in such disguised advertisements. They ought to be attractively written, to serve their purpose; failing to do so, they illustrate the essential inefficiency of bad writing.

Similarly: "The Union Leasing Company has **encountered** a promising vein 10 ft. north of the shaft." You can, if you are not unsympathetic, visualize the episode and, with the eyes of the mind, you will see the company going forth to meet a promising vein, and shaking hands with it at a place 10 ft. north of the shaft.

**Exploitation** and **exploration** are often confused. **Exploit** means to put to use; **explore** means to search. **Exploitation** refers to the extraction and utilization of ore; **exploration** refers to the work involved in looking for more ore. Thus (speaking of faults): "In certain cases, by judicious **exploitation**, the veins have been recovered and production continued." Obviously, **exploration** is meant.

"The **exploration** of the mine has yielded a large output of excellent ore." While ore is broken in the course of exploratory work, it is fairly certain that **exploitation** is intended in this case.

"It is quite clear from local information **that** the manager has gathered **that** large bodies of ore will be found." Probably it was no clearer than the construction of the sentence. The relative pronoun **that** and the conjunction **that** are used in a confusing way. Is it "clear, from local information, that the manager has concluded that large bodies of ore will be found," or is it "clear from local information, collected by the manager, that large bodies of ore will be found"? We presume the latter to be correct.

**Contemplate** is a word dear to the chroniclers of wild-cat operations. The promoters of feline finance "contemplate the inauguration of a campaign of production," the "installation of a mill," or the "placing of a smelter in commission." Thus: "The Granite Mining Co. is **contemplating** the starting of the pumps." You can almost see them; a group of thoughtful men staring at the pumps and expecting them to be willed into movement.

**Estate** is another word belonging to the jargon of the promoter, for it suggests enough of fixed ownership to obscure the fact that the property consists of a number of unpatented claims, the title to which may be lost by failure to do the assessment work. So "the **estate** of the Manhattan Morgan Corporation will be actively explored, the directors having decided to **prosecute** a vigorous campaign of development," which, being interpreted, means that they intend to sink a few prospect holes in order to have an excuse for selling their heavily watered stock. Grandiose language usually indicates flamboyant finance.

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## HINTS IN GRAMMAR

**Subjunctive.**—In conditional sentences the use of the subjunctive mood is correct, but it is dying out so rapidly as to make it seem an affectation, except in the case of **were** for **was**. On the whole, the subjunctive forms are best avoided in technical writing, as being unnecessary, and dangerous to all save the most practised writers.

**Shall** and **Will**.—The idiomatic use comes so naturally to a small minority that they know not how they do it, while to the majority misuse is so ingrained that rules are ineffective. The directions for the employment of **shall** apply to **should**; and those referring to **will**, apply also to **would**.\*

1. When **shall** and **will** retain their original meanings of command and wish, respectively, they are used in all three persons. Thus:

Thou shalt not steal.

You should not say such things.

Whom should he meet but Jones.

I will have my way.

I would not have it done for the world.

A coat will last two years with care.

2. In plain statements as to the future, the first person has **shall**, while the second and third persons have **will**. Thus:

I shall, you will, die some day.

Shall I, will they, be here tomorrow?

We should, he would, have consented if asked.

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\*These rules are taken, with most of the illustrations, from 'The King's English.' Clarendon Press, 1906.

I should, you would, like to go.

3. In future and conditional statements that include an expression of the speaker's wish, intention, menace, assurance, consent, refusal, promise, and so forth, the first person has **will**, while the second and third persons have **shall**. Thus :

I will tell you presently.

You shall repent it before long.

He shall not have any of it.

We would go if we could.

They should have had it if they had asked.

I will drown and no one shall save me.

There are other rules, with their exceptions, but for technical writers these three will suffice. The second rule is the one oftenest broken, without excuse.

**The Possessive Case.**—This is used excessively, and in cases where the preposition **of** is desirable. Thus: "The ore has been compared to a nut struck by a hammer whose blow has separated the valueless shell (the quartz) from the valuable kernel (the gold)." **Whose** is the possessive case of **who**; **which** is not inflected and it is as the possessive of **which** that **whose** is employed in this case. In poetry and by a personification of the thing mentioned, it becomes proper to use **whose**. Thus: "The city whose towers he saw in the distance." In the example quoted above, "hammer" is not used in any personal or poetic sense, and it should read: "A hammer the blow of which has separated, etc." If this sounds queer, re-write the sentence and avoid the dilemma.

Similarly, **its** is often used where **of it** would be better. Thus: "The mine is valuable and its development will furnish scope for an able man." It is more correct to say,

“and the development of it will furnish scope,” for the mine does not possess a development, that engineering result being a consequence of operations performed.

“Clever chemists invent processes whose success hinges on their application in practice.” This can be improved thus: “Clever chemists invent processes the success of **which** hinges on the application of them in practice.”

It may be a matter of taste, or the want of it; those that doubt the advantage of using the preposition in place of the possessive (**of them, of it, of him**, etc., in place of **their, its, his**, etc.) should read Ruskin. But apart from literary form, with which the technical writer is supposed to have no concern, it is a fact that the careful use of grammatical inflections will enable him to express himself more clearly, and that is the whole purpose of the present criticism. For it can readily be retorted that Ruskin mixes his **which** and **that** in order not to interfere with the marvelous assonance of his writing and to preserve a euphony characteristic of a prose style that is finer than poetry, but the technical writer, whom we have in view, aims simply to make his meaning clear, that is, to convey his ideas on practical subjects with the minimum of ambiguity. In poetry, ambiguity may add a charm; in technology, it is a nuisance only. Therefore, keep in mind the rules of grammar, and when the application of them produces a result that is not euphonious or gives a sentence of doubtful meaning, you will know that it needs re-arrangement. In most cases you will find that grammar has been respected at the expense of idiom, or both at the cost of lucidity. Make everything subserve the purpose of your writing, that is, **to be understood beyond peradventure**.

The use of a singular verb with a plural noun is a locu-

tion that bothers many people. It is correct to say that "500 tons of ore is treated daily," because "500 tons of ore" is an aggregate and performs the function of a collective noun. The idea is of a quantity of ore as a whole, all of which is treated in a continuous operation. But it is proper to say: "Five tons of ore were tested in lots of one ton each with different cyanide solutions so as to ascertain what strength of solution would give the highest extraction." Here the idea is of five different entities, each of which was treated by itself. So we say:

"A hundred tons of ore is shipped to the smelter, while 350 tons is milled at the mine."

To many this locution is offensive because it appears illogical; then avoid it by using a different phrasing.

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Many clumsy sentences and awkward locutions may be avoided by a little restraint in the use of prepositions; they are often only meaningless little obstacles interjected into the flow of speech.

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## MINOR MATTERS

**Punctuation.**—This is a subject fitter for a chapter than a paragraph, but the limits of this little essay will not permit of an exhaustive treatment. The aim of punctuation is to indicate the manner in which the writing is to be read; it “does for the eye what vocal stress does for the ear.” Barrett Wendell summarizes the uses of the four principal marks of punctuation thus: “The period is the strongest mark of punctuation; it marks the limits of sentences. The next strongest mark is the colon; weaker, but still stronger than the comma, is the semi-colon; weakest and most frequent of all is the comma.”\* Herbert Spencer adopted the plan of placing actual spaces between the groups of sentences dealing with the separate ideas expressed in a single paragraph. Undoubtedly we could mark the varying duration of vocal pause between words, clauses, sentences, and paragraphs by blank spaces of graduated length, but punctuation marks are deemed the more effective way of doing so.

Abrupt change of thought and opposition of ideas is indicated by the dash, which is overworked by amateurs. The colon suggests a sequel; it serves to introduce a specific statement. It used to be employed to indicate consequential statements: those prompted by the thought preceding; but for such a purpose it has become customary to adopt the semicolon. The latter is now a misnomer, for it is not a half-colon, rather, it is what it resembles, namely, a compromise between the period and comma, the two

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\*‘English Composition.’ Page 83.

marks of which it is built. The interrogation point (?) and the exclamation (!) are used but little in modern writing, being deemed affected, for ideas of doubt and astonishment are expressed more incisively by words than by punctuation.

The comma is needed before the last member of an enumeration that includes three or more. Thus from "Dick, Tom and Harry arrived today," it might be inferred that Tom and Harry arrived in company, and that Dick came by himself. To take an example from technical writing: "This card system divides itself into several parts, namely, correspondence, technical information, catalogues and miscellaneous." This means that there are three subdivisions, one of which is "catalogues and miscellaneous"; if, however, a comma precedes the **and**, the sentence will mean (as intended) that there are four subdivisions, as stated. Also the sentence, "He left a wife, son and daughter." The son and daughter become Siamese twins.

The utility of this function of the comma is seen in the following example: "To obviate excessive expense for power, stoping and hoisting must be done in the day-time." Here "stoping and hoisting" are purposely joined in opposition to "power," as would not be the case, for example, if a writer were in the habit of saying, incorrectly, that "power, stoping and hoisting are three important items of expense." The example quoted at the beginning of this paragraph cannot be misunderstood by those accustomed to write "power, stoping, and hoisting are three items of expense," using a comma before the **and**, to mark the grouping.

The double quotation mark “ ” should be used only to indicate matter actually quoted from a speaker or a writer. The single quotation mark ‘ ’ should be used in giving titles of books or articles, as Bosqui's 'Cyanide Practice.' “Weed read a paper entitled 'Secondary Enrichment of Ore Deposits'.” Use the single quotation also for special or local technical terms, as 'mundic,' 'gusher,' 'fossick,' 'mucker,' 'black jack.' The single quote is apologetic and indicates words not yet accepted in good usage, such as 'graft', 'wild-cat', 'shyster', 'duffer', 'rebater.'

**Carboniferous** is the name of a geological period, which in England (where the term originated) was identified with the formation of coal, but the coal measures of other countries belong to different geological periods, such as the Cretaceous and Tertiary. **Carbonaceous** means containing or yielding carbon. Some writers use 'carboniferous' when they mean 'carbon-bearing' and this makes confusion with **Carboniferous**; for instance, in Missouri there is a Carboniferous limestone that is carbonaceous. Thus: “The mineral solutions came in contact with the carbonaceous material of the lower Coal Measures or some other precipitating agency.” Give words their special duties and so strengthen their significance. Let **Carboniferous** stand for the name of the formation, and **carbonaceous** refer to richness in carbon.

**Region** refers to a large territory of ill defined extent; **district** is applied to a defined and relatively small area. Thus: “The Silverton district is one of the most productive in the San Juan region of Colorado.” “The Wardner district is part of the Coeur d'Alene region of Idaho.” “The zinc and lead mining region of southwestern Mis-

souri includes the Joplin, Webb City, Carterville, Oronogo, Galena, and Baxter Springs districts." "In the Rocky Mountain region the principal mining centres are at a high altitude, as, for instance, the Leadville district, which is two miles above sea-level."

**Camp** is often used as a synonym for **district**, but it becomes a misnomer when once a mining settlement has passed out of its tented or temporary stage of growth. **Field** is employed by Englishmen much as **camp** is used by Americans. "The goldfields of Australia are south of the equator." "On this (the Rand) field white labor is at a discount." "The zinc field of Missouri is prosperous." "The coalfields of West Virginia."

By compounding, the bucolic suggestiveness of 'field' is lessened, so that we employ 'coalfield' and 'goldfield' without a sense of incongruity. Compare 'battlefield.' But as mines are usually in the mountains or on the desert, the use of **field** may well be avoided as being without significance, if not misleading. We have **region**, **territory**, **tract**, **area**, **district**, **belt**. Let the farmer have his **field** and the soldier his **camp**; the miner has words enough for his own purpose.

The word **balance** is used too often as the equivalent of **remainder**. Thus: "The flume has been re-built for a greater part of its length and the balance will be thoroughly repaired." **Balance** suggests equalization, an effort to produce equilibrium or to keep in due proportion. Here it means the remainder or smaller part of the flume. There is no suggestion of poise or adjustment.

**Latinity**.—Elsewhere I have attacked the employment of words of Latin origin when plain English will serve

the purpose. The excessive use of long technical terms is becoming less common as it is realized that they are often unnecessary, besides being ugly and pretentious. We leave them nowadays to the charlatan. Yet some good men err that way, thus: "The mineral is non-cupriferous and auriferous." This was written by a quiet thoughtful writer usually free from pyrotechnics. Is it not better to say that "the mineral contains gold but not copper."

In their effort to splurge, some writers use **silicious** when they mean carrying quartz, which is a particular form of silica; they use **metasomatic** until it becomes only a wordy cloud; and when they say **calcareous**, it is uncertain whether they refer to the presence of aragonite, calcite, or limestone, or merely a composition that includes calcium oxide. They use a long word that is comprehensive but indefinite in place of a short word that is less pompous but more definite. Such writers use **data** and **strata** as if they were singular nouns—a lapse to be debited occasionally against university graduates!

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## SPECIFICATIONS

In preparing manuscript, write on one side of the paper only and use sheets of uniform size. Use the typewriter, if convenient. If written by hand, print all proper names carefully. Allow space between lines so that corrections can be made without crowding. A foot-note should be written in the manuscript immediately under the place to which it refers, and a line should be drawn across the page both above and below it. Foot-notes should be carefully given. An asterisk or other sign may serve to correlate one or two notes, but when many foot-notes are necessary it is best to number them, thus:

<sup>1</sup>R. A. F. Penrose, 'Tin Deposits of the Malay Peninsula'; *Trans. A. I. M. E.*, Vol. XX, pp. 64 to 92.

<sup>4</sup>*Journal Amer. Soc. Nav. Eng.*, Vol. II, Pt. 3, p. 17.

In referring to authors or the names of persons, give the initials. Exercise care in this detail. Any man has a right to be annoyed if his name is spelled wrongly, for it is the one thing that is peculiarly his own.

In tabulated statements, the head of a column should end with a period. Headings should be uniform as regards abbreviation. Single words or the first of the several words in a description should begin with a capital.

Time by the clock may be written thus: 5:40.

Write January 14, not 14th of January.

Instead of 8 in. to 10 in., write 8 to 10 in.; and instead of 30° to 40°, say 30 to 40°.

Capitalize the names of geologic formations and periods: Carboniferous rocks, Red Beds of the Trias, Tertiary period.

Points of the compass ordinarily are not capitalized, except when they refer to a region, as "conditions in the South," "business in the West." This applies also to their derivatives eastern, western, etc., as "in western Colorado," "in southern California"; but "on the Eastern seaboard," "according to Western methods."

Always capitalize State when it refers to a State of the Union (America) or of the Commonwealth (Australia); thus "a state of uncertainty" or "a state of inebriety," but "the State of Montana," "the State of New South Wales," and "the State of Sonora." This rule applies to Territory also, as "the Territory of Alaska."

Capitalize Federal when it refers to the Government, also Empire, Government, Nation, and Republic when they are employed specifically, as: "The resources of the Government," "the future of the Nation," "the wealth of the southern Republic"; but "the republic of letters."

Proper names that have become trade terms are not capitalized. For instance, Bessemer is capitalized only as the name of a man or a town; we speak of bessemer steel, bessemer process. The same rule holds good in portland cement, plaster of paris, german silver, muntz metal, babbitt metal, china clay.

In geographical names the capital is not required for the last member except when important, thus, we have Hudson river but Atlantic Ocean; Delaware bay, but Rocky Mountains. County, lake, valley, basin, and river should not be capitalized, but it is proper to write Coast range, Great Basin, Front range, Great Lakes.

Where the name of a company is not given in full, use a lower case c, as: The Smith company, the North Pacific company. When given in full, a capital C is required,

thus: The Smith Smelting & Mining Co., the North Pacific Railroad Company. Also write 'the Company' when referring to a particular company, the full name of which has been previously given.

Employ italics to signify foreign words: "The property covered 32 *pertenencias*." "The *oficinas* in Chile." "It was a case of *sauve qui peut*." Names of ships, newspapers, and periodicals go in italics: "The *Baltic* sailed today." "The *Times* states." "You will see it in the last *North American Review*."

Preventive	not	preventative
Supposititious	"	suppositious
Partly	"	partially, when meaning in part
Reagent	"	re-agent
Reinforce	"	re-enforce
Farther	"	further, in speaking of distance
Delimit	"	deliminate
Persistent	"	permanent, as applied to ore
Except	"	excepting

Unwater a shaft but dewater a pulp.

**As far as** is applied to undoubted facts, thus: "He went as far as Denver."

**So far as** is used before clauses containing a statement of doubt or varying fact, thus: "So far as known the ore is easy to treat by cyanidation."

Avoid the use of words that are not English.

Thus it is better not to write e.g. but for example

"	"	"	viz.	"	namely
"	"	"	i.e.	"	that is
"	"	"	viâ	"	by way of
"	"	"	vice versa	"	the reverse
"	"	"	in situ	"	in place

In choosing between the use of the terminations **ic** and **ical**, as in geologic and geological, it is well to adopt the practice of restricting the first to natural phenomena, relations, conditions, and products, while the second is used in designating the works of man, as in research, literature, speculation. So that we get:

Geologic formation	Geological survey
Geologic structure	Geological map
Electric energy	Electrical machine
Geographic conditions	Geographical bulletin

The following are correct:

Acquiesce <b>in</b>	Disagree <b>with</b>
Adapted <b>to</b>	Favorable <b>to</b>
Averse <b>to</b>	In view of
Compare <b>with</b>	Necessary <b>to</b>
Consist <b>in</b> gives a definition	Necessity <b>for</b>
Consist <b>of</b> gives a composition.	Need <b>of</b>
Content <b>with</b>	Oblivious <b>of</b>
Contrast <b>with</b>	Tamper <b>with</b>
Differ <b>from</b>	Tinker <b>at</b>
Different <b>from</b>	Vary <b>from</b>
	With a view <b>to</b>

Use **upward**, **downward**, **toward**, omitting the unnecessary **s**, as in **upwards**.

In speaking of the strike of veins, it is not necessary to give the complementary point of the compass. Thus: "The lode strikes northwest," not 'northwest-southeast.' The 'southeast' is an obvious inference.

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## THINGS TO AVOID

Do not begin a paragraph with a present participle, lest you flounder ere the close.

Reject **pristine**, **erstwhile**, and **festive**. They mark the last stage of journalistic vulgarity.

Speak not of the Phoenix and his ashes, nor of the Augean stables, nor of a pilgrimage to Mecca, nor of the labors of Hercules, for such allusions have been worn threadbare long ago.

Avoid dashes and parentheses, which to the reader are as hurdles to a weary runner.

Abstain from italics; let your statements be emphatic without them. Italics, like the underlining in a school-girl's letter, are apt to be over-worked. Reserve them for special occasions.

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## GOOD AND BAD WRITING

It is evident that most writers try to economize the mental effort of the writer, not the reader. Bad writing is generally due to sheer laziness, simply mental and physical sloth. It is easier to be verbose than to be terse; it is less trouble to write than to think. A writer who is explicit has taken trouble; the man who is vague assumes that the reader "will know what I mean." But he won't. Hence much trouble. Poor writing calls forth bad language.

Huxley said that the *ars artium*, the greatest of all arts, was to be able to say: "I do not know." To distinguish between what we know and what we think we know is the beginning of knowledge. This applies to writing. The worst performances in print are made by the men who mix fact with fancy, their knowledge with their ignorance, the things they apprehend with the things they suppose, the crystal and the cloud, neither clear water nor solid land, but a morass into which the farther you go the worse your plight.

To young writers it is well to say: Separate what you know at first hand about your subject from what you have learned at second hand, hold the fact distinct from the theory, not that the one is necessarily better than the other, but they thrive best when kept apart. Barrett Wendell says truly: "To be clear in narrative, or in exposition, or in argument, or in any kind of discourse whatever, we must evidently proceed from what is known to what is unknown." And the method, being logical, is also that followed naturally by the reader, whose mental processes

reflect the activities within the writer's brain—and the more of it the writer gives to his work, the less the reader will have to contribute.

Unpractised writers usually begin an article with one or two paragraphs of valueless generalization, mere wordiness preparatory to an explicit statement, like the tuning of violins before a symphony. The musician cannot help it because the strings of his instrument will not stay taut; they must be tightened to preserve the pitch of the violin. The writer, on the contrary, even if he goes through a preliminary tuning with his pen, need not inflict his reader with the result of such clumsy flourishes; he can delete, and start at the real beginning of his literary effort. And when it is over, there is no need to mask his retreat, like a cuttle-fish, with an inky discoloration of the clear waters of thought. Those who begin with unnecessary tunings are apt to end with gratuitous discords, a wordy introduction is apt to be balanced with a verbose conclusion. Spare your reader both, get to the heart of your subject without loss of his mental energy, and when you have said what you want to say, stop—neither abruptly nor diffusely, but in a frank and friendly fashion that is as polite as it is prompt.

In preparing to write on any subject, it is well to turn it over in the mind, and then to make a list of headings, which stand for separate ideas. If these are put on cards or slips of paper, they can be arranged and re-arranged until the sequence appears logical; if logical, it will be expressive, that is, effective from the reader's point of view. In the course of selecting and shifting the headings, new thoughts will be suggested and the whole matter is put into shape. For the act of writing precipitates

thought, transforming amorphous ruminations into crystalline ideas.

Barrett Wendell has said eloquently that "whatever our subject-matter, our task is to translate the evanescent immaterial realities of thought and emotion into written words. No matter how humble our task may seem, we are really performing, well or ill, an act of creative imagination." Hence the pleasure of the writer who knows that he has, in some sort, transferred to paper the thought that was vibrant in his mind ; it is like the delight of the musician who strikes a true chord and feels the reverberations tingle through every pulse. At best, written language is clumsy ; it lacks the tones and undertones, the expression and gesture, of the spoken word. Most writing stands for but a fraction of the thought that brought it into being ; by the time the words have impinged upon the sight and intelligence of the reader, a large part of the warm life that they had when uttered by the writer has shriveled and grown cold. Only now and then does a man arise, like Huxley or Ruskin, with such a mastery of the pen as to transform the immaterial thought into sculptured writing that glows with vivid life, like the tinted marbles of the Greeks ; then indeed does man rise in proud superiority over the dumb brutes, for the constructive imagination enables him to use the clumsy symbols of his speech and from them elaborate a vehicle of thought by which the experiences and sensations of a fleeting today are transmitted to his descendants in a distant tomorrow. Mortal, he becomes immortal ; created, he becomes a creator.

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## **PARTING ADVICE**

1. Have something to say; then say it.
  2. When uncertain as to your grammar or phrasing, re-write the sentence or paragraph.
  3. But do not tinker at a doubtful sentence; re-construct it thoroughly.
  4. Avoid the use of words the meaning of which is doubtful to you.
  5. Make your meaning clear; then consider style.
  6. Remember the reader.
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## A PLEA FOR GREATER SIMPLICITY IN THE LANGUAGE OF SCIENCE

\*Scientific ideas are with difficulty soluble in human speech. Man, in his contemplation of the flux of phenomena at work all about him, is embarrassed by the want of a vehicle of thought adequate for expression, as a child whose stammering accents do not permit him to tell his mother the new ideas which suddenly crowd upon him when he meets with something alien to his experience.

Our knowledge of the mechanism of nature has been undergoing a process of growth, much of which has been sudden. It is not surprising, therefore, that the incompletely formed ideas of science should become translated into clumsy language and that inexact thinking should be manifested by vagueness of expression. This inexactness is often veiled by the liberal use of sonorous Greek and Latin words.

The growth of knowledge has required an increase in the medium of intellectual exchange. New conceptions have called for new terms. Sir Courtenay Boyle has pointed out that the purity of a nation's coinage is properly safeguarded, while the verbal coinage of its national language is subject to no control. Specially qualified persons prepare the standards of gold and silver. This insures the absolute purity of the measures of commercial exchange and gives the English sovereign and the American gold-piece, for example, an assured circulation along

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\*A paper read before Section E of the American Association for the Advancement of Science, at Denver, on August 28, 1901.

all the avenues of commerce. It is not so with the standards of speech. The nation debases its language with slang, with hybrid and foreign words, the impure alloys and the cheap imports of its verbal coinage, mere tokens that should not be legal tender on the intellectual exchanges. France has an academy which in these matters has much of the authority given to the Mint, whose assay-ers test our metal coins; but in our country the mintage of words is wholly unrestricted, and, as a consequence, the English language, circulating as it does to all the four corners of the globe, has received an admixture of frag-ments of speech taken from various languages, just as the currency given to the traveler in exchange at the frontier, where empires meet, bears the mark of several govern-ments and passes with an equally liberal carelessness.

Science ignores geographical lines and bemoans the babel of tongues which hinders the free interchange of ideas between all the peoples of the earth. Nevertheless, the international character of technical literature is sug-gested by the fact that three languages, French, German, and English, are practically recognized as the standard mediums of intellectual exchange. One of these affords the most lucid solvent of thought, another is the speech of the most philosophical of European people, and the third goes with world-wide dominion, so that each has a claim to become the recognized language of science. The broth-erhood of thinking men will have been fully recognized when all agree to employ the same tongue in their inter-course, but such a "far-off divine event" is not within the probabilities of the present, consequently there re-mains only for us to make the best of our own particular language and to safeguard its purity, so that when it goes

abroad the people of other countries may at least be assured that they are not dealing with the debased coinage of speech.

Barrie has remarked that in this age the man of science appears to be the only one who has anything to say—and the only one who does not know how to say it. It is far otherwise in politics, an occupation that numbers among its followers a great many persons who have the ability for speaking far beyond anything worth the saying that they have to say. Nor is it so in the arts, the high priests of which, according to Huxley, have "the power of expression so cultivated that their sensual caterwauling may be almost mistaken for the music of the spheres." In science there is a language as of coded telegrams, by the use of which a limited amount of information is conveyed through the medium of six-syllabled words. Even when not thus overburdened with technical terms it is too often the case that scientific conceptions are conveyed in a raw and unpalatable form, mere indigestible chunks of knowledge, as it were, which are apt to provoke mental dyspepsia. Why, I ask, should the standard English prose of the day be a chastened art and the writing of science, in a great scientific era, merely an unkempt dressing of splendid ideas? The luminous expositions of Huxley, the occasional irradiating imagery of Tyndall, the manly speech of Le Conte, and of a very few others, all serve simply to emphasize the fact that the literature of scientific research as a whole is characterized by a flat and ungainly style, which renders it distasteful to all but those who have a great hunger for learning.

To criticism of this sort the professional scientist can reply that he addresses himself not to the public at large,

but to those who are themselves engaged in similar research, and he may be prompted to add to this the further statement that he cannot pitch the tone of his teachings so as to reach the unsensitive intelligence of persons who lack a technical education. Furthermore, he will claim that he cannot do without the use of the terms to which objection is made. However, in condemning the needless employment of bombastic words of classical origin, in place of plain English, I do not wish to be understood as attacking all technical terms. They are a necessary evil. Some of them are instruments of precision invented to cover particular scientific ideas. Old words have associations which sometimes unfit them to express new conceptions and therefore fresh words are coined. The complaint lodged against the pompous and ungainly wordiness of a large part of the scientific writing of the day is that it is an obstacle to the spread of knowledge.

Let us consider the subject as it is thus presented. In the first place, does the excessive use of technical terms impede the advance of science? I think it does. It kills the grace and purity of the literature by means of which the discoveries of science are made known. Ruskin, himself a most accurate observer of nature, and also a geologist, said that he was stopped from pursuing his studies "by the quite frightful inaccuracy of the scientific people's terms, which is the consequence of their always trying to write mixed Latin and English, so losing the grace of the one and the sense of the other." But grace of diction is not needed, it may well be said; that is true, and it is also true that a clear, forceful, unadorned mode of expression is more difficult of attainment and more desirable in the teaching of science than either grace or fluency of

diction. One must not, as Huxley himself remarks, "varnish the fair face of Truth with that pestilent cosmetic, rhetoric," and Huxley most assuredly solved the problem of how to avoid rhetorical cosmetics and yet convey deep reasoning on the most complex of subjects in addresses that are not only as clear as a trout stream, but are also brightened by warm touches of humanity, keen wit, and the glow of his own courageous manhood. Nevertheless, though clearness of expression be the first desired, yet grace is not to be scorned. When you have a teaching to convey, it is well to employ all the aids that will enable you to get a sympathetic hearing. Man lives not by bread alone, much less by stones. He likes his mental food garnished with a sauce. Let the cooking be good, of course, but a *chef* knows the value of a *garniture*.

Our language is capable of a grace and a finish greater than we give it credit. That it is possible to write on geology, for instance, in the most exquisitely simple English has been proved by Ruskin, whose 'Deucalion' and 'Modern Painters' contain many pages describing accurately the details of the structure of rocks and mountains, and dealing with their geological features in language marked by the most sparing use of words that have not an Anglo-Saxon origin.

The next aspect of the enquiry is whether the language of science, apart from the view of mere grace of style in literature, is not likely, in its present every-day form, to delay the advance of knowledge by its very obscurity. Leaving the reader's feelings out of the argument, for the present, it seems obvious that the whole purpose of science, namely, the search after truth, which is best advanced by accuracy of observation and exactness of statement, is

hindered by a phraseology that sometimes means very much but often means very little, and, on the whole, is most serviceable when required as a cloak for ignorance. To distinguish between what we know and what we think we know, to comprehend accurately the little that we do know, surely these are the foundations of scientific progress. If a man knows what a thing really is, he can say so, describing it, for example, as being black or white; if he does not know, he masks his ignorance by stating in a few Greek or Latin terms that it partakes of the general quality of grayness. Writers get into the habit of using words that they do not clearly understand themselves and that, as a consequence, must fail in conveying an exact meaning to their readers. Many persons who possess only the smattering of a subject are apt to splash all over it with words of learned sound, which are more quickly acquired, of course, than the reality of knowledge. Huxley said that if a man does really know his subject "he will be able to speak of it in an easy language and with the completeness of conviction with which he talks of an ordinary every-day matter. If he does not, he will be afraid to wander beyond the limits of the technical phraseology which he has got up." If any scientific writer should complain that simplicity of speech is impracticable in dealing with essentially technical subjects, I refer him to the course of lectures delivered by Huxley to working-men, lectures which conveyed original investigations of the greatest importance, in language that was as easily understood by his audience as it was accurate when regarded from a purely professional standpoint.

Science has been well defined as "organized common sense"; let us then express its findings in something better

than a mere jargon of speech and avoid that stupidity which Samuel Johnson, himself an arch-sinner in this respect, has fitly described as "the immense pomposity of sesquipedalian verbiage." George Meredith, a great mint-master of words, has recorded his objection to "conversing in tokens not standard coin." Indeed the clumsy Latinity of much of our scientific talk is an inheritance from the schoolmen of the past; it is the degraded currency of a period when the vagaries of astrology and alchemy found favor among intelligent men.

Vagueness of language produces looseness of knowledge in the teacher as well as the pupil. Huxley, in referring to the use of such comprehensive terms as 'development' and 'evolution,' remarked that words like these were mere "noise and smoke," the important thing being to have a clear conception of the idea signified by the name. Examples of this form of error are easy to find. The word 'dynamic' has a distinct meaning in physics, but it is ordinarily employed in the loosest possible manner in geological literature. Thus, the origin of a perplexing ore deposit was recently imputed to the effects produced by the "dynamic power" that had shattered a certain mountain. 'Dynamic' is of Greek derivation and means powerful, therefore a 'powerful power' had done this thing; but in physics the word is used in the sense of active, as opposed to 'static' or stationary, and it implies motion resulting from the application of force. In the case quoted, and in many similar instances, the word 'agency' or 'activity' would serve to interpret the hazy idea of the writer, and there is every reason to infer, from the context, that he substituted the term 'dynamic power' merely as a frippery of speech. It is much easier to talk grandiloquently

about a 'dynamic power,' which perpetrates unutterable things and reconstructs creation in the twinkling of an eye, than it is to make a careful study of a region, trace its structural lines, and decipher the relations of a complicated series of faults. When this has been done and a writer uses comprehensive words to summarize activities that he has expressly defined and described, then indeed he has given a meaning to such words and he has a right to use them.

In this connection it is amusing to remember how Ruskin attacked Tyndall for a similar indiscretion. The latter had referred to a certain theory, which was in debate, and had said that it, and the like of it, was "a dynamic power which operates against intellectual stagnation." Ruskin commented thus: "How a dynamic power differs from an undynamic one, and, presumably, also, a potestatic dynamis from an unpotestatic one—and how much more scientific it is to say, instead of—that our spoon stirs our porridge—that it 'operates against the stagnation of our porridge.' Professor Tyndall trusts the reader to recognize with admiration."

Among geological names there is that comfortable word 'metasomatosis' and its offspring of 'metasomatic interchange,' 'metasomatic action,' 'metasomatic origin,' etc., etc. To a few who employ the term to express a particular manner in which rocks undergo change, it is a convenient word for a definite idea, but for the greater number of writers on geological subjects it is a wordy cloud, a nebular phrase, which politely covers the haziness of their knowledge concerning a certain phenomenon. When you don't know what a thing is, call it a 'phenomenon'!

Instances of mere vulgarity of scientific language are

too numerous to mention. 'Auriferous' and 'argentiferous' are ugly words. They are unnecessary ones also. The other day a metallurgical specialist spoke of 'auriferous amalgamation' as though any process in which mercury is used could be gold-bearing unless it were part of the program that somebody should add particles of gold to the ore under treatment. A mining engineer, of the kind known to the press as an expert, described a famous lode as traversing "on the one hand a feldspathic tufaceous rock" and "on the other hand a metamorphic matrix of a somewhat argillo-arenaceous composition." This is scientific nonsense, the mere travesty of speech. To those who care to dissect the terms used it is easily seen that the writer of them could make nothing out of the rocks he had examined save the fact that they were decomposed, and the rock which he described last might have been almost anything, for all he said of it; since his description, when translated, means literally a changed matter of a somewhat clayey-sandy composition, which, in Anglo-Saxon is m-u-d! The 'somewhat' is the one useful word in the sentence. Such language may be described in the terms of mineralogy as metamorphosed English pseudomorphic after blatherumskite. Some years ago, when I was at a small mine near Georgetown, in Colorado, a professor visited the underground workings and was taken through them. He immediately began to make a display of verbal fireworks, which bewildered the foreman and the other miners whom he met in the mine—all save one, a little Cornishman, who, bringing him a bit of clay that accompanied the walls of the lode, said to him, "What do 'ee call un, you?" The professor replied, "It is the argillaceous remnant of an antediluvian world." Quick

as a flash came the comment, "That's just what I told me pardner." He was not deceived by the vapor of words.

Next consider the position of the reader. It is scarcely necessary at this date to plead for the cause of technical education and the generous bestowal of the very best that there is of scientific knowledge. The great philosophers of that New Reformation which marked the era of the publication of 'The Origin of Species' have given most freely to all men of their wealth of learning and research. When these have given so much we might well be less niggardly with our small change and cease the practice of distributing, not good wholesome intellectual bread, but the mere stones of knowledge, the hard fossils of what were once stimulating thoughts. In the ancient world the Eleusinian mysteries were withheld from the crowd and knowledge was the possession of a few. Do the latter day priests of science desire to imitate the attendants of the old Greek temples and confine their secrets to a few of the elect by the use of a formalism which is the mere abracadabra of speech? Among certain scientific men there is a feeling that scientists should address themselves only to fellow scientists, and that to become an expositor to the unlearned is to lose caste among the learned. It is the survival of the narrow spirit of the dark ages, before modern science was born. There are not many, however, who dare confess to such a creed, although their actions may occasionally endorse it. On the whole, modern science is nothing if not catholic in its generosity. "To promote the increase of natural knowledge and to forward the application of scientific methods of investigation to all the problems of life" was the avowed purpose of the greatest of the philosophers of the Victorian era.

There are those who are full of a similar good-will, but they fail in giving effect to it because they are unable to use language that can be widely understood. In its very infancy geology was nearly choked with big words, for Lyell, the father of modern geology, said, seventy years ago, that the study of it was "very easy, when put into plainer language than scientific writers choose often unnecessarily to employ." At this day even the publications of the Geological Surveys of the United States and the Australian colonies, for example, are occasionally restricted in usefulness by erring in this respect, and as I yield to none in my appreciation of the splendid service done to geology and to mining by these Surveys, I trust my criticism will be accepted in the thoroughly friendly spirit with which it is offered. It seems to me that one might almost say that certain of these extremely valuable publications are 'badly' prepared because they seem to overlook the fact that they are, of course, intended to aid the mining community in the first place, and the public whether lay or scientific, only secondarily. From a wide experience among those engaged in mining I can testify that a large part of the literature thus prepared is useless to them, and that no one regrets it more deeply than they, because there is a marked tendency among this class of workers to appreciate the assistance that science can give. Take, for example, a sentence like the following, extracted from one of the recent reports of the U. S. Geological Survey: "The ore forms a series of imbricating lenses, or a stringer lead, in the slates, the quartz conforming as a rule to the carunculated schistose structures, though occasionally breaking across laminae, and sometimes the slate is so broken as to form a reticulated de-

posit." This was written by one of our foremost geologists and, when translated, the sentence is found to convey a useful fact, but is it likely to be clear to anyone but a traveling dictionary? A thoroughly literary man might know the exact meaning of the two or three very unusual words which are employed in this statement, but the question is, will it be of any use whatever even to a fairly educated miner, or be understood by those who pay for the preparation of such literature, namely, the taxpayers? An example of another kind is afforded by a Tasmanian geologist who recently described certain ores as due to "the effects of a reduction in temperature of the hitherto liquefied hydroplutonic solutions, and their consequent regular precipitation." These solutions, it is further stated, presumably for the guidance of those who wield the pick, "ascended in the form of metallic superheated vapors which combined eventually with ebullient steam to form other aqueous solutions, causing geyser-like discharges at the surface, aided by subterranean and irrepressible pressure." At the same time certain "dynamical forces" were very busy indeed and "eventuated in the opening of fissures"—of which one can only regret that they did not swallow up the author as Korah, Dathan, and Abiram were once engulfed in the sight of all Israel.

It will be well to contrast these two examples of exuberant verbosity because the first befores the statement of a scientific observation of value, made by an able man, while the second cloaks the ignorance of a charlatan, who masquerades his nonsense in the trappings of wisdom. Here you have an illustration of the harmfulness of this kind of language, which obscures truth and falseness alike, to the degradation of science and the total confusion of

those of the unlearned who are searching after information.

Let the writer on scientific matters learn the derivation of the words he uses and then translate them literally into English before he uses them, and thereby avoid the unconscious talking of nonsense. If he knows not the exact meaning of the terms that offer themselves to his pen, let him avoid them and trust to the honest aid of his own language. "Great part of the supposed scientific knowledge of the day is simply bad English, and vanishes the moment you translate it," says Ruskin. The examples already given will illustrate this. "Every Englishman has, in his native tongue, an almost perfect instrument of literary expression," so says Huxley, and he illustrates his own saying. Huxley and Ruskin were wide apart in many things and yet they agreed in this. Ruskin proved abundantly that the language of Shakespeare and the Bible can be used as a weapon of expression keen as a Damascus sabre when it is freed from the rust of classic importations, which make it clumsy as a crowbar.

There is yet another reason against the excessive use of Greek-English words, in particular. Greece is not a remnant of extinct geography, but an existing land with an active people and a living language. The terms that paleontology has borrowed from the Greek may be returned by the Greeks to us. And, as Ruskin points out, "What you, in compliment to Greece, call a 'Dinotherium,' Greece, in compliment to you, must call a 'Nasty-beastium,' and you know the interchange of compliments can't last long."

In all seriousness, however, is it too much to ask that such technical terms as are considered essential shall not be used carelessly, and that in publications intended for

an untechnical public, as are most government reports, an effort be made to avoid them and, where unavoidable, those that are least likely to be understood shall be translated in foot-notes. Even as regards the transactions of scientific societies, I believe that those of us who are active members have little to lose and much to gain by confining the use of our clumsy terminology to cover ideas which we cannot otherwise express. By doing so we shall contribute, I earnestly believe, to that advancement of science which we all have at heart.

In furtherance of this principle we must remember that language in relation to ideas is a solvent, the purity and clearness of which affect what it bears in solution. Whewell, in 'The Philosophy of the Inductive Sciences,' has expressed this view of the matter with noble eloquence. "Language," he said, "is often called an instrument of thought, but it is also the nutriment of thought; or rather, it is the atmosphere in which thought lives; a medium essential to the activity of our speculative powers, although invisible and imperceptible in its operation, and an element modifying, by its qualities and changes, the growth and complexion of the faculties which it feeds."

In considering the subject from this standpoint, there is borne upon the mind a suggestion that carries our thought far beyond the confines of the matter now under discussion. Such power of speech as man possesses is a faculty that appears to divide him from all other living things, while at the same time the imperfection of it weighs him down continually with the sense of an essential frailty. To be able to express oneself perfectly would be divine, to be unable to make oneself understood is human. In 'Man's Place in Nature,' Huxley points out that the

endowment of intelligible speech separates man from the brutes which are most like him, namely, the anthropoid apes, whom he otherwise resembles closely in substance and in structure. This endowment enables him to transmit the experience which in other animals is lost with each individual life; it has enabled him to organize his knowledge and to hand it down to his descendants, first by word of mouth and then by written words. If the experience thus recorded were properly utilized, instead of being largely disregarded, then man's advancement in knowledge and conduct would enable him to emphasize much more than it is permitted him at present, his superiority over the dumb brutes. Considered from this standpoint, language is a factor in the evolution of the race and an instrument that works for ethical progress. It is a gift most truly divine, which should be cherished as the ladder that has permitted of an ascent from the most humble beginnings and leads to the heights of a loftier destiny, when man, ceasing to stammer forth in accents that are but the halting expression of swift thought, shall photograph his mind in the fulness of speech, and, neither withholding what he wants to say nor saying what he wants to withhold, shall be linked to his fellow by the completeness of a perfect communion of ideas.

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## STANDARDIZATION OF ENGLISH IN TECHNICAL LITERATURE

\*It should not be necessary to apologize for submitting the consideration of this subject. Whether my views prove acceptable or not, is a small matter; my aim in addressing you is to engage your interest in matters not alien to the purpose for which this Institution was organized—to direct your attention to the intelligent use of words in technical writing. Whether you agree with my views on the subject is of no vital consequence if only by arousing your critical faculty, you may be induced to use in a thoughtful way words and phrases that you now employ thoughtlessly, or, shall I say, habitually, without having taken the trouble to consider the fundamental principles involved. Let us agree to disagree, if you will; but let us unite in performing an important part of our professional work in a scientific manner, as becomes technical men.

“Science and Literature are not two things, but two sides of one thing.” So said Huxley; and he illustrated his own saying, until his writings became as glimpses of the obvious, and his lectures windows into the infinite. We need to be reminded occasionally that science is not divorced from literature, and that even technology is not compelled to go about as if legally separated from good English. As technical men we are always ready to lay stress on the necessity for precision, yet when we come

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\*A portion of a paper read before the Institution of Mining and Metallurgy, at London, on May 26, 1910.

to record the observations and conclusions gathered and formed during a laborious career we are apt to use the first verbal implements at hand, instead of chiseling our speech with the tools given to us by the masters of language. As well try to cut a statue out of marble with a dull adze as express scientific ideas by aid of colloquial words, local terms, and vulgar idioms; as well paint a sunset with a scrubbing brush.

The purpose of language is to convey ideas; the intent of technical writing is to transmit accurate information, whether as fact or theory, from one man to another, to the gain of all. Indeed, the benefit is usually more to the giver than to the receiver. In the exchange of ideas, it is particularly true that it is more blessed to give than to receive. No man learns so much from the writing of a book or an article as the author himself. It has been well said that if you wish to learn all about a subject, write a book on it. At the start the writer finds his knowledge as full of holes as a sieve, and his thought as turbid as the pulp from a stamp-mill. In the effort to convey information by writing he crystallizes the amorphous ideas collected during years of study and observation, he submits the confused notions in his brain to the settling process of logical thinking, whereby the true is precipitated from the false, the accurate is decanted from the inaccurate, fact is filtered from supposition, and finally the solution of speech, pellucid but enriched, is outpoured generously.

The value of such a performance, either to the author or to his readers, depends upon the manner of it. There be those that write on a subject only helplessly to obscure, only hopelessly to obfuscate, only stupidly to mislead.

Even men possessing individual experience or exceptional knowledge may fail in conveying either the one or the other, because they make careless use of the medium employed. A notion used to prevail, and still survives, that nicety in the use of words is, in a practical man, almost effeminate. To some people the effort to write correctly is deemed an affectation, as if it were not as essential to the comprehension of the long-suffering reader as to the understanding of the author himself, whose ideas are clarified by using a correct medium of speech. The turbid pulp in a mill is made clear by passing through classifiers and settlers. Not until a technical man sits down and begins honestly to tell what he knows on any given subject does he find out how hazy is his information; and if he indulge in vague generalities, careless terms, and involved idioms he never will render himself or his ideas clear, either to himself or to his readers. Thus an intelligent use of the medium of written speech is self-discipline, to which every serious worker ought to submit himself at regular intervals, as a measure of efficiency and a stimulus to betterment.

Huxley said that Spencer's idea of tragedy was a theory killed by a fact; my idea of the tragic is the vast amount of useful information that is lost by being unrecorded. What enormous quantities of notes, the embryonic beginnings of scientific literature, remain undeveloped and are finally cast into the fire. It may be that some of them are better fitted to light the hearth than to fire the imagination, but at least I would have them sifted and sorted if haply they may contain nuggets of information or gems of thought. Every year some mining engineer or metallurgist dies leaving a bulky col-

lection of notes, useless to anyone but himself, and useless at last even to himself; such notes may relate to unique observations or individual experience, the record of which would be as stepping stones to those that follow. In some cases the aim has been to complete the study of a subject before rushing into print, as if anything were complete in this transitory world. Nothing is more pathetic than this expectation of saying the last word on a subject; it never will be said; the best we can do is to contribute our little all as a mite to the great legacy of knowledge and then hope to merit an epitaph like that of John Richard Green: "He died learning."

The amount of first-hand information possessed by any man is pitifully small; we are all hopelessly in debt to others, to our contemporaries, to our forefathers, to the race. Yet each man possesses some little bit of knowledge, whether as observation, theory, or experience, that is his very own. Thus each can contribute something to the general fund; and seeing how much he owes, it is asking but little that he give cheerfully what he can. Of course, narrow minds still continue to fondle the mean belief that to give information gratuitously is to throw away a stock in trade, and that to keep secret the professional or technical experience of a life is to possess an added weapon in the arena of industry. But this is a pitiable fallacy scarcely worthy of castigation. If adopted universally we would be today as the Hottentot or the Eskimo; civilization has been evolved by the free exchange of thought and the frank transmission of experience. Whether we be advocates of free trade, fair trade, or reciprocity in matters of national industry, let us at

least reject the shriveling policy of protection as applied to the worldwide traffic in ideas.

Science is organized common sense; technology is the precise expression of special knowledge. The ordinary information of an average man is like a pile of fire-wood, disorderly and bulky; the fund of useful information possessed by the technical man is like an orderly arrangement of fuel, in definite lengths, arranged so as to be easily measured and readily available. The result is due to an intelligent effort; it is not accident.

"The development of the mind is an advance from the indefinite to the definite." The technical man in his processes, whether of the mill and smelter, or in the reducing operations of his mind, follows a similar line of progress. His constant effort is to distinguish between what he knows and what he thinks he knows, between fact and fancy, between observation at first-hand and information at second-hand. And when he comes to place himself on record he should follow an identical course; but with a difference. In his technical operations he deals, in the main, with insentient matter; in his technical writing he must keep in mind the human element, for he is not writing on stones to be placed in a desert but on paper to be read by his fellows. To be effective, sympathy is needed, as well as knowledge; otherwise the effort will be sterile. Spencer, who studied style as an adjunct to philosophy, has said: "The good instructor is one in whom nature or discipline has produced what we may call intellectual sympathy—such an insight into another's mental state as is needed rightly to adjust the sequence of ideas to be communicated." In other words: **Remember the reader.** Every writer may not care to pose

as an instructor, but, in effect, every serious writer does instruct to useful purpose according as he renders himself receptive to the reader by employing words in a convincing and agreeable manner. "Those are the most effective modes of expression which absorb the smallest amount of the recipient's attention in interpreting the symbols of thought: leaving the greatest amount for the thought itself." So Spencer said. This is the first principle of writing: economy of mental effort. Put yourself in the reader's place; if you do, sincerely and honestly, you will succeed in avoiding all the grosser errors of style and expression that prevent language from becoming pictorial, that hinder the transfer of ideas, and retard the transport of thought.

In technology, as in science generally, the tendency exists to employ impressive words as the symbols of vague ideas instead of using plain speech to express definite notions. Thus we have that comfortable word 'metamorphism', and that weak word 'dynamic'; in economic geology the phrase 'secondary enrichment' is often used when the phenomena might indicate primary impoverishment. We use the word 'phenomenon' itself as if it stood for something definite; it means an unexplained 'appearance'; when we do not know what a thing is, we call it a 'phenomenon'. Macaulay said: "I have often observed that a fine Greek compound is an excellent substitute for a reason." We use sonorous multisyllables like "the chunk of Old Red sandstone" that was thrown by one of the disputants in the row that disrupted the Society on the Stanislaus, as related by Bret Harte.

Apart from the failure to convey information, the use of impressive terms often entails a failure on the part of

the writer to understand himself. It is easier to refer to a 'phenomenon' than to explain it, to impute to 'metamorphism' the thermal and physical changes that are seen as through a glass darkly, and to debit 'secondary enrichment' with vagaries in ore distribution that elude the comprehension of the mining engineer. Here again self-discipline should precede the attempt to teach. Permit me to quote Samuel Johnson: "To explain, requires the use of terms less abstruse than that which is to be explained, and such terms cannot always be found. For as nothing can be proved but by supposing something intuitively known, and evident without proof, so nothing can be defined but by the use of words too plain to admit of definition." Lest this sententious dictum should intimidate you, I quote another saying of the great lexicographer: "There is for every thought a certain nice adaptation of words which none other could equal, and which when a man has been so fortunate as to hit, he has attained, in that particular case, the perfection of language."

While objecting to the reckless use of local terms and mere vulgarisms I hope to escape the charge of pedantry. Of course, it is possible to cramp the use of language by too much self-consciousness, by the priggishness of a pedagogue, or the pettiness of a pedant. My objection is not to the thoughtful use occasionally of local terms, or even slang, if thereby the meaning of the writer be made clearer, but to the thoughtless and unintelligent adoption of corrupt forms of speech. I do not object to the use of an unscholarly word or an unfamiliar idiom if either of these is adopted deliberately in order to express ideas not to be appreciated when clothed in more conventional

terms; but I do protest against blunders arising from mere lack of care and to wilful ignorance of the simplest rules regulating the effective employment of language as a vehicle of thought. You will remember Macaulay's pleasant correspondence with Napier, the editor of *The Edinburgh Review*: Napier had objected to the use of phrases that were flippant and of words that were colloquial. Macaulay vindicated himself by referring to the practice of Addison, "the model of pure and graceful writing," arguing that a little levity of style was occasionally desirable as a relief from continued earnestness and dignity. He went on to say: "The first rule of all writing—that rule to which every other is subordinate—is that the words used by the writer shall be such as most fully and precisely convey his meaning to the great body of his readers. All considerations about the purity and dignity of style ought to bend to this consideration." And it is safe to say that Macaulay himself did not find it necessary to sacrifice the extraordinary high level of his style to the attainment of expression or to lucidity of thought. If those who use the wretched vulgarisms and careless colloquialisms that disfigure so much technical literature can find in Macaulay's plea for flexibility any warrant for their sins, they are welcome to the solace, but I fail to see any likeness between the intentional levity or reasoned laxity of a careful writer and the unintentional blunders or thoughtless errors of a careless scribbler. We do not need to become as self-conscious as the centipede of whom it is related that he managed to get on well enough until one day he became aware of his hundred feet, so that he tripped and fell by the wayside in a hopeless tangle; nor in transferring thought from

ourselves to others by means of the vehicle of language need we imitate the reckless driver who blunders into all the ruts, over all the stones, into all the puddles, and ends by taking the wrong turning, so that his load of fodder never reaches its intended destination, but is scattered in a disorderly mess over the roads of half a county.

The language used in technical writing may be likened to the food we eat. One man says that he wants plain cooking; that he does not care for highly seasoned dishes; and that rich entrées disgust him. Another has a delicate palate and objects to mere chunks of meat and plain boiled vegetables; he asks for something daintier and more appetizing. As a matter of fact, so-called plain food easily degenerates into what the American calls 'hash', it may be so tasteless and sodden as to be palatable only to a hungry man, while on the other hand the rich sauce and delicate garniture soon pall to the satiety of *toujours perdrix*. In writing, as in cooking, in the intellectual as in the physical nourishment, it is necessary to avoid extremes and to keep in mind the purpose of the performance. The ideal is good food, well cooked, and judiciously seasoned, neither so crude as to be unpalatable nor so elaborate as to cloy the taste. Further, in literature as in gastronomy, the purveyor of nourishment will recognize the necessity for adapting his products to the taste of those whom he desires to please or to strengthen, varying his viands accordingly. Writers that start with the idea of naturalness and simplicity of literary manner, are apt to deprecate the tricky allurements of the stylist until they themselves write uncouthly and may take such pains not to be florid as to become merely bucolic. Their counterpart is the writer who obtains so much enjoyment when

weaving words as to forget the object in view, and is so particular as to the manner as to overlook the matter. Both errors of extreme can be cured by paying attention to the fundamental rule: **Remember the reader.** When you cook, remember who is to eat the meat. *A mousse de vollaile* would disgust a bricklayer, but a plate of pork and beans might nauseate a bishop.

So, Gentlemen, I have felt warranted in trespassing upon your courtesy; I deem myself justified in calling your attention to a subject that seems at first sight only academic but is in truth as practical as any other appertaining to the work of the engineer. Next to doing things is the ability to state clearly how they are done; next to the possession of useful knowledge is the power to impart it to others. Men are known by their deeds, but more men are known by their writings; the deed is forgotten, the writing remains. We judge the men we have not met by the letters, reports, and other writings emanating from them; there is an acquaintance wider than that of personal contact and more intellectual than that of the dinner table. To a young engineer the ability to write tersely and clearly is an accomplishment that makes him favorably known to those in authority. Many a youngster has obtained the chance of promotion because he compiled his routine reports so that they were instinct with intelligence instead of being dead bundles of words. This is only reasonable; for a crisp and clear manner of writing can come only from vigor and lucidity of thought, such as indicate the efficiency for which the engineer continually strives. Until you meet a man, you judge him by his letters; until you have seen the work of a technical man, you judge him by his reports. Therefore I urge the

younger supporters of the Institution, particularly the students, to give heed to this function of the engineer; the older members may be past hope, for the proverb says that you cannot teach new tricks to an old dog, and in any case I do not expect my contemporaries to accept my views as authoritative, but to the younger men I can appeal with the enthusiasm of reform and with the conviction of experience, beseeching them to give heed to a matter the practical importance of which is undeniable and the neglect of which is a serious blemish upon a profession that should combine the precision of the technologist with the liberality of the scholar.

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The subject is 'standardization,' spelt with a **z**, not with an **s**. It is well to begin at the beginning and to standardize the first term used in the discussion that follows. So I make a plea for the use of the last letter of the alphabet, in place of the sibilant, in words involving the idea of agency. Such usage is phonetic and conforms to the Greek derivation. We should write 'surprise' with an **s**, but 'realize' with a **z**. In words such as 'civilize,' 'emphasize,' 'apologize,' and 'authorize,' the termination **ize** has been adopted by the Oxford English Dictionary, the highest authority on such a matter. This usage was heartily endorsed by Herbert Spencer and by William Skeat. It is not an Americanism, although in vogue among educated Americans.

The third word in the title to this communication is 'English.' As I view the use of language, there are many dialects, such as British, American, and Australian, but

there is only one English language. What happens to the dialects I do not greatly care; but the corruption of the one language of our race is an evil against which I protest. We miners are the worst sinners in corrupting the verbal coinage minted by the masters of English prose. By our nomadic life and by our reckless borrowing of words from every country into which we penetrate in the search for minerals we are continually introducing counterfeits into the currency of our English speech, until it needs careful examination to distinguish between the genuine and the spurious.

**Spurious Words.** From the sailors that left their ships to follow the rush to Ballarat and Bendigo, we got the word **reef**; to the ignorant immigrants who caught the gold fever of 1849, and went to California, we owe the word **ledge**. In both cases, the combs of gold-bearing quartz appearing above the surface of the ground suggested terms prompted by the rudimentary ideas of people without previous experience in mining. Thus we became burdened with **reef** and **ledge**. These words are not needed; long before they were introduced we had **lode** and **vein**, both of which express all that **reef** and **ledge** express, and more besides. **Reef** has gained in dignity by adoption in South Africa, but it has not been universally accepted throughout English-speaking countries; it is not an English word; it is only British. **Ledge** has failed to win recognition outside America; it is local and unnecessary. Even the original significance of **reef**, at first as a ridge of rock appearing above the surface of the sea and then as a similar excrescence on the land, has been lost. In the case, for instance, of the Giant mine in Rhodesia, the word is applied to an orebody having no outcrop and

(according to the Company's engineers) so shapeless as to have neither strike nor dip. **Lode** is a good Anglo-Saxon word, meaning something that leads the miner to the discovery of ore; neither size nor richness, shape nor origin, is involved. Hence it covers any kind of ore deposit, from a big lens to the stringer connecting large masses of ore. It is a comprehensive term. And if the tabular persistent type of ore deposit is to be designated, we have the word **vein**, carrying with it all those suggestions of continuity and ramification that it owes to an earlier use in physiology. **Lode** and **vein** are easily translatable into foreign languages, in which they find their counterparts, but **reef** and **ledge** are bewildering to a conscientious translator. The test of translation is one to be commended.

**Goldfield** is a term sanctioned by use, and it has its analogues in **coalfield** and **oilfield**. The two latter have an obvious significance, for oil and coal are often found under a level surface, properly called 'fields.' For **goldfield** there is less excuse, because gold is usually mined in regions so mountainous as to suggest the antithesis of fields. Perhaps the park-like character of the country around Ballarat and Bendigo is responsible for this, as for other queer usages. However, let us accept **goldfield**; it has won a place in the language and cannot now be rejected. But what shall be said of 'field' and 'fields,' without the compounding with gold, coal, or oil. In descriptions of the Rand it is not unusual to find references to happenings "on these fields," meaning "in this district." The phrase is bucolic. When not tied to the word 'gold,' as in **goldfield**, the use of 'field' fails utterly to suggest the idea of a locality devoted to the industry of

mining. It is as yet only a vulgar localism, to be avoided by anyone retaining a respect for correct English.

**Field** has a companion in verbal iniquity: I refer to **camp**, which is used with similar carelessness in America. For example, writers in the daily press and illiterate mining engineers speak of "Cobalt camp," the fact being that Cobalt is a town, a well established settlement, which has developed far beyond the shifty condition of a pioneer outpost.

The beginnings of a mining community, when tents are pitched close to the place of mineral discovery and before fixed habitations are erected, may not improperly be called a **camp**. It suggests the habitation of explorers. But to apply the word to towns possessing all the complex equipment of civilization is to beggar speech and to use baby language. Let us eschew both **field** and **camp**. For individual places, we have **locality**; for a number of places grouped together, we have **district**; for large tracts of country, including many localities and several districts, we have **region**.

**Vulgarisms.** Among the worst linguistic solecisms are the Australian words **paddock** and **mullock**, and the American **muck** and **leaser**. The sailors and sheep-herders who introduced **paddock** from the farm into the mine, using an enclosure for cattle to designate a receptacle for ore, had some excuse, not knowing better, but educated men who employ such bastard terms have no excuse whatever. From **mullock**, as meaning waste rock, we get **mullocker**, the man who shovels the waste, and **mullocking**, the operation itself. All three of them ought to be scrapped. **Muck**, **mucker**, **mucking**, and other inspiring derivatives, are gaining ground among the illiterate re-

porters who fill the local Western American press with inaccurate trivialities. **Muck** is dirt, that is, matter in the wrong place. Previously we had been burdened with **pay-dirt**, and **dirt** in a general sense as meaning ore; thus **mill-dirt**. But ore when broken underground is neither filth nor manure, nor even matter in the wrong place; it is essentially in place, from which it is torn laboriously by the use of tools and explosives. The shattered metal-bearing rock handled by the miner is not rubbish; even when barren, it comes clean from the manufactory of Nature. The rubbish of language is not needed to designate either the ore, the man that moves it, or the process by which it is transferred from the stope to the shaft.

In a mine the valuable product is **ore**; the valueless is plain **rock**; the man who shovels either is a **shoveler**; the process is picking, shoveling, and tramping. Yet it was written in an article supposed to be technical: "After the shooting is over, the mucker goes to work, the drill man climbs to the top of the muck, and by the time the four feet of ground shot down is mucked out, he is again ready to shoot his holes." This is the very muck of writing. Imagine an educated Frenchman trying to translate this verbal garbage into his own exquisitely precise language, or an Englishman, ignorant of mining, attempting to decipher such jargon. **Leaser** is used as a synonym for **lessee**. This is not only objectionable as a vulgarism but upsets the true meaning of words. **Leaser** is a corruption of **lessor**, and it is given as such in standard dictionaries. The man who lets a mine on lease is a **lessor**, and the man who takes the lease is the **lessee**; to call him a **leaser** is to turn language inside out. The error arose through ignorance, and it is perpetuated by carelessness.

Not that I object to the introduction of new words to designate new ideas, for such additions enrich the language. Thus 'indicator,' 'laccolite,' 'bonanza,' 'tundra,' 'geyser,' are examples of terms from various sources, all of which aid the power of English speech. They stand for ideas not represented by any English word; they strengthen, rather than corrupt, the language of Shakespeare and Milton, of Ruskin and Huxley. A language grows by such accretions; it is thus that English has borrowed from every country with which our people have traded or fought. But importations should not be made heedlessly, especially into that part of the language devoted to the expression of the precise ideas of technology.

**The Significance of Words** is lessened by giving them a variable meaning; the word that has many meanings fails to carry any particular meaning strongly; by employing words out of their strict sense we enfeeble language. This is particularly true in technology; if words are to be employed with precision they must not be dulled by undiscriminating usage. Thus, **locate** and **location** are used in mining to signify the act and the result of the act of delimiting a claim by placing monuments or stakes at the corners of a given area. If, however, **locate** and **location** be used in other senses, as the synonym for 'situate,' 'reside,' 'selecting a site,' and so forth, confusion may be caused, lessening the force of the words when employed correctly. Thus:

"He **located** the Midas claim on January 15, 1909."

"He sold the Midas **location** to the Exploration Company."

These illustrate correct technical usage, but the following are incorrect:

1. "The mine is **located** in Northern Rhodesia."
2. "The mill was **located** on Strawberry creek."
3. "Mr. John Smith is now **located** at Silverton."
4. "The superintendent **located** the ore-shoot on the fifth level."

Some of these are American colloquialisms, but they are creeping into English as spoken by mining men and even educated engineers. In the first, the word **located** is redundant; omit it, and the sentence loses nothing. In the second, the objectionable word should be replaced by 'erected,' 'built,' or 'constructed,' unless it is meant that the *mill-site* was **located** at the place designated. A *mill-site* is **located** like a mining claim and by much the same procedure, but a *mill* is *made* by manual labor applied to selected material. The third contains a common Western Americanism; in this case Mr. Smith should be described as 'living' at Silverton, or as 'residing' there, or more specifically, as having 'rented a house' or an office in that locality. In the last example the superintendent 'found' the ore-shoot, or 'ascertained the position' of it, or 'obtained a clue' how to reach it by cross-cutting and driving; here a vague and incorrect term should be replaced by one that is accurately significant.

**Carboniferous** and **carbonaceous** furnish a further example. If a farmer is writing, he may be forgiven if he use the two terms interchangeably as meaning carbon-bearing, but a technical man should know that the first is the name given to a geological period, and the second to substances containing carbon. In order further to distinguish terms somewhat similar it is usual to give the first the capital C and to spell the second with a small c. In England, where **Carboniferous** originated, the name

was given to the strata of a period identified with the formation of coal, but the coal measures of other countries, such as New Zealand and Colorado, are found in rocks of Tertiary and Cretaceous age, and in those countries the **Carboniferous** strata do not yield coal, although they are co-eval with the series bearing that name in Great Britain. Moreover, a rock may be both **Carboniferous** and **carbonaceous**, as in Missouri, where a limestone belonging to a period immediately succeeding the Devonian is black with the product of decomposed vegetal remains.

**Cement**, **cementing**, and **cementation** are used in a perplexing manner. A **cement** is "a substance that, by hardening, causes objects between which it is applied to adhere firmly." And the binding of fragmentary material by means of a mortar-like substance that subsequently hardens is called **cementing**. Careless writers, however, appear to think that it is elegant to use **cementation**, forgetting that in metallurgy the latter is a term applied to "a process of causing a chemical change in a substance by heating it while embedded in a powdered mass of another substance," as converting wrought iron into steel in a bed of charcoal. **Cement**, associated usually with the idea of binding material, is employed in metallurgy to describe a finely divided metal obtained by precipitation, as 'cement-copper.' This use is unnecessary, for 'precipitated' copper is more descriptive. Let words, especially technical terms, be kept for specific uses, thereby giving them an unmistakable and definite meaning. There is usually a word for each duty; nothing is gained by confusing these duties; on the contrary, a word taken from

its proper sphere to perform the task already allotted to another becomes degraded.

**Partly** and **partially** are, by most people, used interchangeably, so that both suffer by the exchange. Even a speaker so skilful as Lord Rosebery said recently: "It is perhaps better to speak with no knowledge of the game [of golf] than with a **partial** knowledge of the game." Here **partial** is used as the synonym of 'incomplete'; and we know that no golf-player could possess an **impartial**, or unprejudiced knowledge, of the ancient and honorable pastime. I am reminded of the mayor, who, on being asked to preside at a political meeting, and wishing to emphasize the fact that he officiated in no partisan capacity, said: "I am not here as a politician; I am neither **partial** nor **impartial**." **Partly** and **partially** are different words, so are **partial** and **in part**. In the transactions of this Institution it is recorded that members have given "partial" analyses of various ores, when, of course, an **impartial** analysis was required, and a composition **in part** or 'incomplete' was meant.

A technical writer begins his description of a district by offering "the following **partial** history," when we expect from him a perfectly unbiased account of its early development. Another man was "**partially** inclined to adopt filter-pressing instead of decantation by reason of the greater simplicity of the latter process;" from which one would infer that he had been subventioned by the makers of iron vats, despite the blandishment of filter-press manufacturers. It may be that only once in twenty times is a confusion created by such interchangeable use of two words possessing different shades of meaning, but the general effect is to dull the fine edge of their signifi-

cance, and to unfit them for the rare occasions when we draw upon the full measure of their strength as vehicles of thought.

**Calcining** and **roasting** lose in value by careless use; **calcining** should be applied to the process for removing carbon di-oxide from carbonates, and **roasting** should be restricted to the expulsion of sulphur by heat in the presence of oxygen.

**Strike** has two distinct and opposite meanings: a shareholder is frightened by a **labor strike** and delighted with the news of a **strike of rich ore**. Another technical use of **strike** refers to the trend or direction of a vein of ore or a stratum of rock as stated in points of the compass; this is an old and well-established usage. As **strike** belongs peculiarly to the economics of labor, and also to geology, some other word should be employed to designate the finding of ore. There are plenty: we can say that rich ore has been 'found,' 'discovered,' 'cut,' or 'intersected'; we can speak of the 'find,' 'discovery,' or 'uncovering' of rich ore. A level 'reaches' the ore, the miner 'breaks' into an orebody, the drill-hole 'penetrates' a bonanza. In fact, it is easier to find a synonym than to discover the rich ore.

**Payable** is a vulgarism now rampant on the Rand. Ore does not **pay** nor is it **paid**, literally. A thing is **payable** when it is unpaid and due, or when it is capable of being discharged by payment. What is meant is, that the exploitation of the ore yields a profit. Why not say so, and use the word **profitable**? A thing is **profitable** when it produces or results in profit. An ore capable of yielding 18s. per ton in a mine where the total cost of operations is 18s. per ton is **payable** in the colloquial sense,

but it is not **profitable**, for to be that it must yield more than 18s. per ton. Therefore, **payable** and **profitable** are not even synonyms. The confusion in verbal meaning has produced an economic confusion on the Rand, as elsewhere, and exemplifies the demoralizing effect of a loose terminology.

Confusion between time and place is shown in such expressions as these :

“**At times** the ore shows free gold.”

Meaning: “**In places** the ore shows free gold.”

“Traces of oxidation are **sometimes** seen at a depth of 850 feet.”

Here, **sometimes** should be replaced by a word or phrase indicating relative position in place, not time, for the ‘oxidation’ can be observed—by aid of a miner’s candle—by day or night, at dawn or sunset. If the ‘oxidation’ is not everywhere visible at a depth of 850 ft., it should be stated where it is to be seen, for that would indicate the conditions modifying the chemical action signified by the word ‘oxidation.’

**Preposition-Verbs.** Another fault to which we Britishers are prone is the excessive use of the preposition-verb, that is, a verb followed immediately by a preposition, as ‘meet **with**,’ ‘fill **up**,’ ‘carry **on**,’ and so forth. In German such preposition-verbs are compounded, so that they become harmless, although still unlovely. In British speech they are usually followed by another preposition, as: “The richest mine I met **with in** my travels.” When spoken, the first preposition follows the verb without a pause so that the second receives fuller emphasis, but when printed there is no such distinction; hence the expression becomes awkward. Another effect is to cause

repetition, as in the *Westminster Gazette*, where I found the following: "One of the conclusions **at** which Lord Rosebery had arrived **at** in the study of Dr. Johnson is that he would have made a splendid journalist."

Further, the use of preposition-verbs may entail the ending of a sentence, or even a paragraph, with an insignificant word, the preposition coming last. William Dean Howells in *Harper's Magazine* (July, 1909), concludes an article thus: "This is the climax I have been working **up to**, and I call it a fine one; as good as a story to-be-continued ever ended an instalment **with**." This is a childish anti-climax, and I marvel that so skilful a writer should be guilty of phraseology so slovenly.

In *The Climber*, by E. F. Benson, a writer of high repute, it is written: "Lucia flicked **off** **with** the tassel of her riding whip a fly that her mare was twitching **its** skin to get rid **of**." Note how two prepositions are huddled into helpless collision, explaining in part the resulting confusion of gender.

A humorist once stated the rule thus: "Never use a preposition to end **up** a sentence **with**."

The following additional examples will suggest the frequent use of this peculiarly British idiom:

1. "He can be depended **on to** be loyal."
2. "The consulting engineer will work **out** a system of metallurgical treatment."
3. "The proceedings ended **up with** a dinner."
4. "Amalgamation has been done away **with** on the Rand."
5. "Before arriving **at** any decision, the directors decided to carry **out** more experiments."

6. "The stock of tools was disposed of to the tributaries."
7. "Plans are being drawn up for erecting new furnaces."
8. "The company starts off with plenty of capital."
9. "It is necessary to keep up a steady policy of development."
10. "This product is dealt with later by cyanidation."
11. "Work is being carried on on the Violet claim."
12. "The furnace is charged with fine silicious ore previously wetted down."
13. "The sulphides come in on the next level."
14. "Water came in at considerable pressure."
15. "New tubing was put in without disturbing the old."
16. "Henry Potter was called in to apply his method."

Instances might be multiplied with the greatest facility; scarcely a page of a report or a technical article is free from this verbal blemish. Once attention has been directed to this awkward locution you will become restive whenever you see or hear it, and in the end you will instinctively avoid it. It is easy to do so; for every preposition-verb there is a synonym that expresses the same meaning better.

Thus, in the first example, **depended on** can be replaced by 'trusted.'

In the second, **work out** can be replaced advantageously by 'devise.'

In the third, **ended** is better without the **up**, and 'concluded' covers the ground perfectly.

The fourth is a particularly heinous offence, and one

common enough; three prepositions follow each other in single file and two of them can be dropped by substituting the word 'discarded,' in lieu of **done away with**.

In the fifth, the directors might have decided to 'make' further experiments before 'reaching' a final decision.

In the sixth, it is probable that the tools were 'sold'; if not, let us be informed exactly how they were transferred.

In the seventh, **up** is redundant; or **drawn** may be replaced by 'prepared,' since **drawn up** does not necessarily refer to the work of a draftsman.

In the eighth, the company might just as well **start** plainly without the **off**.

In the ninth, **keep up** is a clumsy substitute for 'maintain.'

In the tenth, **dealt with** is vague, sloppy, and untechnical. 'Treated' may serve, but 'leached' may state the fact more correctly. Whatever is done to the product, let it be stated explicitly.

In the eleventh the preposition is repeated, the first one doing duty as an adverb. The awkwardness of this is apparent; in speaking, the first **on** follows closely after **carried**, as if they were compounded, but in print there is no suggestion of this intimate relation.

In the twelfth it may be imagined what would happen if the ore were wetted **up**, and it is inferred that by being wetted **down** it becomes so moistened that dust does not rise **up**! Let us re-cast the sentence and say that "the furnace is charged with fine silicious ore previously wetted."

In the thirteenth we have an extremely common usage; the ores do not come, either **in**, **on**, or **out**; the miner

comes to the ore and finds it by hard digging. The sentence can be amended thus: "Sulphide ore is first cut on the next level."

The fourteenth is similar; here, **came in** can be replaced by 'entered,' or 'flowed,' or 'ran,' or 'spurted,' as the case may be, and it would do any of these **under**, not **at**, high pressure. **Considerable** is a poor word; it is merely vague. A speaker, entangled in verbiage, once said concerning a proposal that "it was a considerable consideration that should be carefully considered."

In the fifteenth, **put in** seems almost unavoidable, but 'inserted' is better.

In the sixteenth, Mr. Potter might be 'retained' or 'engaged.'

In most of these the preposition linked to the verb is followed by another preposition, and when reading such sentences there is occasional difficulty in recognizing immediately the proper function of each separate preposition. It may be argued that all preposition-verbs cannot be dispensed **with**, but I venture to say that we can avoid the use of preposition-verbs, as in this last sentence.

An elderly lady, discussing street-corner bookmakers, said that "they ought to be taken **up** and put **down**," meaning that they should be arrested by the police and suppressed by the law.

Why should we melt **down** a charge and melt **up** a slag? Why should we settle **down** in the country in order to settle **up** our debts in the City? Why should we put **up** with this clumsy use of words when we can gain lucidity by discarding the bad habit?

I beg you to give this little detail your earnest consideration; you will be repaid. Re-arrange the sentence and

substitute synonyms; above all, select words that accurately express your meaning and reject this infantile jargon so disfiguring to English speech.

**The Indefinite Pronoun.** Next, I venture to draw attention to a habit peculiarly British; I refer to the use of the indefinite pronoun **one**. This habit may express the conventional self-repression of the well regulated Britisher, and, as so regarded, it has the merit of modesty; but it is out of place in technology. A technical writer is a scientific witness whose testimony is valuable because he himself vouches for the accuracy of it, therefore the hiding of his egotism under the mock-modesty of the indefinite pronoun is contrary to the purpose supposed to prompt his utterance. If a witness in a court of law were asked at what time he passed the spot where a murder was committed, he would not be allowed to reply: “**One** dines late, therefore **one** did not walk to the club until half-past nine,” meaning “I dined late, therefore I did not walk, etc.” The fact that *he*, the witness, did this or that was the only reason for admitting the testimony and the only reason why it possessed any value as elucidating the circumstances under investigation.

Technical writers are witnesses to the truth; as a rule the main reason for recording the statements made by them is the fact that their personal equation is such as to give value to the testimony, otherwise their observations might just as well be put into a phonograph or a pianola and serve as a counter-irritant to the *blasé* or the *ennuyé* of Oshkosh and Kalamazoo.

To begin a statement with the first personal pronoun **I** may be assertive; at least, it asserts the responsibility

of the writer, it identifies the witness, and places him on record as testifying to the fact. To begin with **one** is to start under a cloud of impersonality, to leave it uncertain whose testimony is cited, and to detract from the feeling of responsibility reasonably to be expected.

An engineer not unknown to some of my readers is in the habit of beginning his remarks by saying: "I myself personally," accentuating his own responsibility for the statements emanating from him. This may be an extreme form of emphasis; indeed many will be inclined to call it 'bad form,' but it is preferable to the weak irresponsibility typified by the impersonal pronoun. In technology, 'bad form' is less objectionable than obscurity.

Obscurity of phraseology is not always accidental. I knew an editor, who, on being invited to examine any new machinery, would avoid the trouble; yet, while deeming it a waste of time, he wished to give his readers the idea that he had actually made an investigation; so he used to start a 'leader' by saying: "We have recently had the opportunity of inspecting Mr. John Robinson's machine, etc." The careless reader would assume that the 'opportunity' had been utilized.

The use of **one** is a British idiosyncrasy, born of false elegance and strengthened by convention; it is misused most by those who deem precision to be academic and confuse the thoughtful use of words with pedantry.

In the *Westminster Gazette*, it was written recently: "Then cricket will become a sport without nerves, and **one** of which **one** will willingly become a spectator." Here the numeral and the pronoun are used confusedly.

Lord Rosebery remarks that "The less **one** says about a toast **one** knows nothing about the better for **one's** self

and the audience.' ' Here it is a wearisome affectation.

An experienced journalist writes: "Of all places Chicago occurs to **one** as the most gloomy and the most oppressive, as more eloquent of the smoke, noise, and bustle of American life than most American cities." This reflection is only interesting when backed by the personality of the writer; as the view of a syndicate, 'combine,' chimera, or mob, it has no value.

In technical writing it is well to sacrifice elegance to directness of statement; the writer on mining and metallurgy is called, not to pose, but to speak to the point without wasteful circumlocution or mincing affectation. A few examples taken from published writings will illustrate:

In a recent bulletin of this Institution I find the following: "One had noticed that in Cornwall it was remarkable that the miners had never been able to get rid of the influence of the smelters in selling their ore."

This observation is only valuable because made by Mr. A.; as a supposition imputed to the man in the street it is not worth recording. The sentence may be amended thus:

"I have noticed that in Cornwall the miners, when selling ore, appear unable to avoid the influence of the smelters."

On the next page of the same bulletin, Mr. B. is recorded as saying: "The mines in the Malay were chiefly worked on the open-cast system; **one** found, however, the Chinese working in shafts to depths of 80 or 90 ft. or more." Also: "One might see within quite a small area 30 or 40 shafts working."

These observations likewise are penetrating only on

account of 'the man behind the gun'; it is Mr. B. who has examined the locality and actually seen the Chinese in these shafts; it is a particular engineer and not a disembodied spirit that has gathered these facts. As generalizations, they are valueless; as records of specific experience, they are worthy of preservation. Therefore the change should be made thus: "I saw the Chinese working in shafts as deep as 80 ft. or even more; and I myself saw as many as 30 shafts within a single area of —," here the dimensions should be stated. 'Small' means nothing until we have been informed regarding the speaker's idea of size.

On the next page Mr. C. gives information on prospecting in Pahang. He says: "One used generally to prospect with a cocoanut shell, and where one wanted to try a piece of ground on a bigger scale the thing would be to take down a tree, beat the bark off, spread it out, and use that as a launder. One would follow, etc. One also came across very curious furnaces, etc."

Is not the reader of these sentences entitled to enquire whether it was a pallid adumbration or a live man that went prospecting, cut down trees, made launders, washed tin-bearing gravel, and saw "curious furnaces." These observations are only interesting because backed by the intelligent identity of Mr. C.; if ascribed to John Doe or Richard Roe, they are worthless; as technical testimony they vanish into thin air.

The whole description has an air of unreality; it bears the signs of a London fog. If one wanted to try a piece of ground, etc., one would do it as described. But as Mr. C. undertook to test the supposed gravel, he ought to eliminate the vagueness, delete the one, omit the very,

reject such a vulgarism as "the thing would be," and take off, not only the bark of a tree, but his coat, preparatory to using English undefiled.

In the same bulletin, it is recorded that Mr. D. said: "His impression was that if **one** added strong sulphuric acid to a pulp which had less than its full proportion of water, **one** was encouraging the acid to waste its energies in taking up the alumina and not the copper. **One** got a better extraction by diluting the acid." Again the same speaker said: "On the other hand, **one** could not neutralize all the free acid, but **one** could get complete precipitation before neutralization was complete."

The affected modesty of the indefinite pronoun robs these statements of their value as emanating from a metallurgist of high repute. No nebulous nonentity performs metallurgical experiments, nor are they performed by accidental aggregates of persons, but by a specific individual possessing special fitness for such work. Not everybody could get a better extraction by diluting the acid. Conceivably it might be done so clumsily as to spoil the chemical operation. Not everybody could get complete precipitation, but Mr. D. might, simply because he had done such work successfully on previous occasions. We want the testimony of a witness, not the hearsay of the market-place.

Therefore the foregoing sentences can be amended advantageously thus: "My impression is that the addition of strong sulphuric acid to a pulp containing less than its full proportion of water tends to cause a waste of acid by reason of the solution of the alumina, rather than the copper. A better extraction is obtained by diluted acid. On the other hand, all the free acid cannot

be neutralized, but complete precipitation is practicable before neutralization is effected."

In this amended version I write in the *first*, instead of the *third* person; the reporting of discussions in the *third* person is based on parliamentary custom, but it is one that ought to be discarded, for it often causes confusion, and always requires the editing of remarks that could otherwise be recorded in the *ipsissima verba* of the speaker. Nothing is gained, and something is lost, by the old custom.

Quoting again, I find that Mr. E. wrote concerning heavy stamps: "**One** could take it, however, that as the whole question was purely **one** of ultimate economy, etc." "Whilst **one** could readily grant these points were of minor importance they must not be entirely overlooked." "**One** found then that as Mr. Caldecott believed in the use of fine crushers with a light stamp, he must further believe that, etc."

"In **one** instance **one** had anything but a positive discharge and a positive feed, whilst in the other, **one** had both of these points absolutely defined."

"There were other considerations that prevented **one** from arriving at any settled conclusion."

In two of these quotations the pronoun **one** and the numeral **one** are brought into awkward collision. It is a fact that all these statements of Mr. E. have value as coming from a practical worker in the field of wet metallurgy; as generalizations imputed to a consensus of opinion they are worthless; most of them are debatable, and were debated.

It will be noted that I have gone freely to the bulletins of the Institution for examples of the misuse of this word.

Whether frequency in the use of it be due to the authors of papers, to the official reporter, or to the honorary editors I do not know, and I evade personal criticism by not knowing.

The correct use of **one** in statements of an impersonal character is not difficult to distinguish from the sloppy usage against which I have ventured to protest. Here is an example:

“**One** cannot foretell how long an inundation such as this will continue to spread, but as **one** investigates the local situation from day to day **one** appreciates more fully the widespread structural injury to buildings and streets.” The first **one** is used properly, but unnecessarily, while the last two are incorrect. The first refers to an impersonal idea, the other two refer to the personal observation of the writer, an English correspondent writing from Paris to an English newspaper. The paragraph may be amended thus:

“Nobody can foretell the duration of an inundation, but as I investigate the local conditions from day to day, I become impressed by the widespread structural injury already done to buildings and streets.”

Permit me to give another example:

“**One** hesitates to prophesy the outcome of the election, but **one** feels the urgent need to fight the socialistic propaganda of the Chancellor of the Exchequer.”

Here, also, the first **one** is attached to an impression of a general character such as might emanate from the man in the moon or the shadow of a peripatetic philosopher, but the second **one** introduces a violent partisan who makes a statement undoubtedly repugnant to at least half the community; therefore, the mock-modest in-

dividual who expresses so decided an opinion ought to use the first person singular, and accept the full responsibility of the pronoun **I**.

Further examples of the misuse of the impersonal pronoun could be given; every bulletin of this Institution is full of them, every technical article contains them, falsifying the style and obscuring the sense. Such resultant vagueness of diction leaves it uncertain whether the writer is stating conclusions founded upon his own experience, or is merely proffering the distillate of opinions supposed to be generally accepted. The chimera ruminating in a vacuum concerning the advisability of second intentions, or the nigger looking for a black cat at midnight in a coal cellar, is no better type of the obscure than this little word **one**, with its three letters and three-score meanings. If once your attention is fully directed to the havoc played by this essentially British—not English—usage, you will, I feel confident, avoid it as a serious blemish in the accurate and intelligible expression of your ideas by means of technical writing.

**The Unnecessary Plural.** Now I come to a tendency concerning which I have spoken on other occasions and in other places. This bad habit of squandering a useful inflection ought to be checked, and, I am proud to say, has been checked. When it was decided recently by the leaders in technical science at Johannesburg to prepare comprehensive treatises on the mining and metallurgy of the Rand, the style-sheet sent to contributors bore the request that they use 'slime,' 'concentrate,' 'tailing,' and so forth, in the singular unless the reference was to several kinds of these products. I take this opportunity of expressing my keen appreciation of this practical compli-

ment. It is a distinct victory against a Mormonism of style that simply robs us of a most useful inflection.

Since the above words were written the members of this Institution have had an example of grammatical self-restraint in Walter McDermott's paper on fine concentration, in which he discarded the use of the unnecessary plural. I venture to say that any careful reader of that most suggestive paper can detect the greater clearness of expression attained by the recognition of the difference between **slime** and **slimes**, **sand** and **sands**, **concentrate** and **concentrates**, and so forth. In a kindred article by Gelasio Caetani, on the 'Milling of Lead-Silver Ore,' appearing in the current issue of *The Mining Magazine*, those who are critical will find another example of the clarification of technical writing by the proper employment of a useful inflection. Surely it is an advantage to know that the writer is referring to *several* kinds of **middling** when he says **middlings**, and only *one* product when he says **middling**; that he has in mind *one* particular type of residue when he uses the word **tailing**, or the product from a particular machine when he says **concentrate**, and a number of such products when he says **concentrates**; that the **slime** from *one* jig can be mixed with the **slime** from *another* jig and the resultant **slimes** can be subjected to the same process or be kept separate for diverse treatment, according to circumstances intelligible to the millman.

If people will persist in saying "the ores" of a mine and "the rocks" of a locality when they refer to *one* kind of ore and *one* variety of rock, they deprive themselves of the distinction between singular and plural.

If a mill produces a lead concentrate and a zinc con-

centrate you can say that it produces concentrates; but if you speak thus of *one* kind of concentrate such as iron pyrite, yielded by the simplest type of gold-bearing quartz ore, you have no means of establishing the difference between *one* product and *two* products.

**Tailing, slime, and concentrate** are to be found in the dictionary, yet one might infer that they did not exist until invented by a hypercritical editor. A **tailing** is the refuse from the wet metallurgical treatment of an ore; if the refuse from several processes or from several mills be mentioned, it is correct to call them 'tailings.' In a cyanide plant several kinds of **slime** are separated from several grades of **sand**, and when these products are united in fact or in description they become 'slimes' and 'sands,' but not until then.

We speak of 'fines': why not 'coarses'? The minutely comminuted product from a crusher is the **fine**, which is separated, by screening or classification, from the 'coarse'; if several discharges of fine stuff are mingled they make 'fines,' but if the **coarse** from several directions is mixed it is barred by euphony from becoming 'coarses.'

But surely euphony does not forbid the wider use of the singular; on the contrary, the excessive sibilant becomes unpleasant in such compounds as 'slimes-plants,' 'sands-vats,' and 'tailings-sumps.' They sound better, and they are correct, in the form of 'slime-plants,' 'sand-vats,' and 'tailing-sumps.'

From the current descriptions of mining regions it might be supposed that 'schists' always existed in multitudinous variety, for it is rarely indeed that a writer is content to say that **schist** is found. A lode is said to penetrate **schists** and **limestones** as if several formations

or several varieties of these rocks were to be indicated; but often it will prove that the writer associates the plural with the multiplicity of strata, using **limestones** as the equivalent of numerous *layers* of **limestone**.

Pluralizing has gone so far that semi-literate people will talk of "stratas"; educated men speak of "data," as if it were the singular (saying "that data"), and I have known even **foliae** to get into print as the plural of **folia**, in forgetfulness that it is itself the plural of **folium**. All of which goes to show that the singular of these terms (**stratum**, **datum**, and **folium**) is so little used as to have passed into innocuous desuetude.

Further examples will illustrate:

"The labor situation **on these fields** is critical." Apart from the glaring vulgarism of a phrase common on the Rand, it is a fact that the writer was referring to a single goldfield and **not** to several.

"In January we treated 3186 tons of **concentrates**, and produced 2711 tons of **calcines**." One kind of concentrate was treated, yielding a calcine similarly uniform in character. The plural is wasted.

"In December the furnaces were fed with **concentrates** from different mines of variable composition, but making a charge so mixed as to average 22% in sulphur." Here we have the correct use of the plural, the significance of which would, however, be lost if employed after the preceding quotation.

"Our **costs** for roasting are of little value on account of," etc. Why not **cost**? He refers to one concrete figure, not to several. If he spoke of the **costs** of crushing, roasting, and smelting as amounting altogether to a

specified sum, then he would be correct, for he would be referring now to three different items.

“The reason for the low tonnages is that 45% of the blast furnace charge is **concentrates**.” As a matter of fact, the one significant word that remains in the singular ought to be in the plural, for several blast-furnaces were involved, but only one kind of concentrate. Why not say: “The reason for the low tonnage is that 45% of the blast-furnace charges is **concentrate**.”

“The decrease in the reduction **costs** to 3s. per ton had the effect of increasing the ore **reserves** to 200,000 tons.” The **cost** of reduction is one item, not more; and the stock of available ore is a **reserve**, not several reserves.

“The large **capacities** now talked of were with the use of coarser screens.” Here we have the preposition-verb (“talked of”) producing an awkward sentence. Two meaningless plurals are employed. The sentence can be amended thus: “The large capacity quoted was rendered possible by the use of coarse screens.”

“Extensive tracts of auriferous gravels.” He meant an “extensive tract of auriferous gravel”; the reference was to one tract only and to one kind of gold-bearing gravel. He thought the plurals sounded more comprehensive, finer, and larger; so he squandered a useful inflection like a sailor on the spree.

“These estates contain important deposits of iron ores as well as gold and copper ores.”

Only one kind of iron ore—namely, hematite—was known to exist, hence the plural was wrong; but the gold and copper occurred in diverse ores, therefore in that case the plural was right. The property consisted of one con-

solidated estate; the use of "estates" is due to careless magniloquence.

**Profit** and **cost** are employed less frequently than 'profits' and 'costs,' especially the first, because the plural form looms bigger. As a matter of fact there may be occasional justification for 'costs,' as including several different items of expenditure, but the 'profit' is usually not known until the end of a series of operations has been reached, and constitutes a single item of account.

Another incorrect use of the plural is connected with the word **company**. We are told that "the **company** intend to erect a new mill," or the **company** have decided to pay a second dividend," or "the **company** are rich in property, as they own 14 claims and a mill-site." In the first of these quotations the word **company** is used in the place of 'management,' in the second instead of 'directors,' and in the last instead of 'shareholders.' A **company** is an organization of shareholders, the directors are trustees for the shareholders, and the management is the executive selected by the directors to supervise operations. Therefore, in making statements concerning the affairs of a company, it is well to say what part of the organization is meant. Moreover, the company as a corporation is a legal entity, it is a unit, and should be followed by a verb in the singular.

The same is true of such words as the **Government**, the **Opposition**, the **House of Lords**, the **United States**. We read that "the **Government** have decided to insist on the abolition of the veto heretofore exercised by the House of Lords." Here "the **Government**" means the members of the Cabinet acting together and regarded as a unit; therefore it should be said that "the **Government**

**has** decided, etc.” Similarly, “the **House of Lords** is in session” and “the **Opposition is** willing to pass the Budget,” not, as usually stated, the House of Lords or the Opposition **are** doing this or that. “The **United States is** a country offering free scope to individual talent;” this is correct, unless we mean to refer to the individual States of the Union.

But these examples may seem to depart from technology; let us consider the common usage of the plural after quantities, thus: “2000 tons **were** treated in the new stamp-mill.” Here the idea is that all of this ore was treated in one continuous operation and as one specific quantity of material, therefore the verb ought to be in the singular.

Take another example: “Five tons of ore **were** separately tested by five different treatments with a view to selecting the process most suitable.” Here the plural idea *is* involved, for each of the five tons was individually subjected to experimental treatment. “76,000 tons of slime and 12,500 tons of zinc tailing **have** been sold.” But: “40,450 tons of concentrate **has** been purchased.” “£3827 **was** spent on capital account and £13,000 **has** been applied to development.” “The ore reserve amounts to 107,000 tons, which **is** mostly below the fifth level.” “£115,000 **is** the purchase price, and £60,000 **has** been subscribed for working capital.” To say that “£115,000 **were** the purchase price, and £60,000 or 60,000 pounds **have** been subscribed,” is to suggest that the price was paid sovereign by sovereign, instead of a lump sum, and that the subscriptions were received in driblets instead of in large checks.

**Meaningless phrases** that may serve to disarm crit-

icism in casual conversation are singularly out of place in precise writing. Examples will illustrate:

(1) "The dryness of the season has not hindered milling, at least **not to any extent**."

(2) "The belief exists **to some extent** that the ores are due to secondary enrichment."

(3) "The gold veins, occurring **as they generally do** in the schist, are not permanent."

(4) "The reefs are generally found to conform to the stratification of the country-rock **in which they occur**."

These examples of pretentious ineptitude could be multiplied indefinitely. They are common; they are the mark of an incomplete grasp of the subject and of an obscurity that is disguised as mock-modest profundity. Other errors are more obvious: **Permanent** is used for 'persistent'; no vein is **permanent** except by being left untouched; it is the extraction of ore that makes it impermanent. Stratification is only applicable to country-rock; the 'reefs', or more properly **lodes**, could not conform to the stratification of any rock except that in which they exist; if their dip happened to be parallel to the stratification of distant rocks, the fact would not be illuminating. These four mongrel sentences may be amended thus:

(1) "Milling has not been seriously hindered by the dryness of the season."

(2) "A belief prevails that the ore is the result of secondary enrichment."

(3) "The gold veins traverse schist, and are not persistent."

(4) "The lodes generally conform to the stratifica-

tion." Other variations may commend themselves, according to the taste of the individual reader.

To any extent, to some extent, and to a certain extent are usually redundant, and the last is the most objectionable, for the word **certain** in such a context means **uncertain**, if it means anything. I am reminded of a Chancellor of the Exchequer who expressed himself as endorsing his opponent's argument "to a certain extent." Gladstone turned to Trevelyan, the biographer of Macaulay, and whispered: "Endorse to a certain extent! What a phrase! we want your uncle back among us." **Certain** is a definite word used with a most indefinite meaning. It is the basis for one of the commonest vulgarisms of English speech. Thus:

"A **certain** amount of mining law is required by every mining engineer."

The writer means that a smattering or slight knowledge, at least, is essential. There is nothing **certain** about the amount of the knowledge indicated.

Again: "A **certain** amount of money has been set aside for a mill." This may mean a fixed or definite amount; but it may also mean an unknown or indefinite amount. The word is merely a sound signifying nothing.

The painting of the lily is no more supererogatory than the verbal decorations used by those who bespatter their sentences with vain adverbs. **Very** is useful according to the rarity of its employment; as ordinarily employed, it is without meaning; in ninety-nine cases out of a hundred, it can be dropped; occasionally **very** defeats its purpose, weakening rather than intensifying the meaning. Thus "a **very** perfect extraction" is not as complete as "a perfect extraction;" the first suggests 97%, the second 100%.

Other examples may be quoted:

“A **most** ideal product.”

“A **quite** perfect separation.”

“A **rather** unique process.”

In each case the adverb weakens the adjective. Things that are **ideal**, **perfect**, or **unique**, permit of no qualification. They are *hors concours*.

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